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THE X-RAY IN THE DIAGNOSIS OF GASTRIC ULCER AND ITS SEQUELÆ[1]

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FOR the past eight years (1), European investigators have endeavored to increase the accuracy of gastro-intestinal diagnosis through the aid of the Röntgen ray. It is to be regretted that a method which gives promise of such an advance in methods of gastro-intestinal diagnosis, and which owes its inception to an American, Cannon of Boston (2), should have awakened in this country as yet so little interest as compared to that evinced by German and English clinicians and Röntgenologists. Little has been done in our country in the way of confirmation of work already done or toward familiarizing us with an already voluminous literature.

A number of unusual factors make the situation rather a difficult one. In the first place, the field is open to two classes of investigators of totally different training and attainments, both of whom are called upon to deal with an entirely unfamiliar subject, the Röntgenologist and the clinician, not to speak of the surgeon, proctologist, etc. The clinician is deficient in knowledge of X-ray technique, its possibilities and limitations, and lacks ability from lack of training to interpret either plate or fluoroscopic image. The Röntgenologist while enjoying an advantage in his knowledge of X-ray technique, is at as great, perhaps a greater, disadvantage. His lack of appreciation of the value of an anamnesis, of the methods of abdominal physical examination, of alimentary physiology, and of that difficult attitude which the gastro-enterologist must maintain toward the question of functional disturbances, make his position a difficult one, and render him, if he be so deficient from lack of clinical association, almost dangerous in a considerable proportion of cases in which the X-ray findings must be correlated with the clinical; the very cases in which the X-ray examination is most needed and upon which the therapy often the question of operation depends. The only rational solution of the problem is a co-operation on the part of clinician and Röntgenologist in the utilization and development of the method. In this alone, it seems to us, lies the solution and attainment of valuable results.

The cases which form the basis of this paper are from the Medical Out-patient Department and Hospital of Washington University. The X-ray work was done under the supervision of the Department of Surgery; operative work from the same source. We wish especially to express our indebtedness to Drs. Dock, Murphy, Myer and Sachs for their assistance and encouragement.

[1] From the Washington University Hospital. Read before the Saint Louis Medical Society, February 1, 1913.

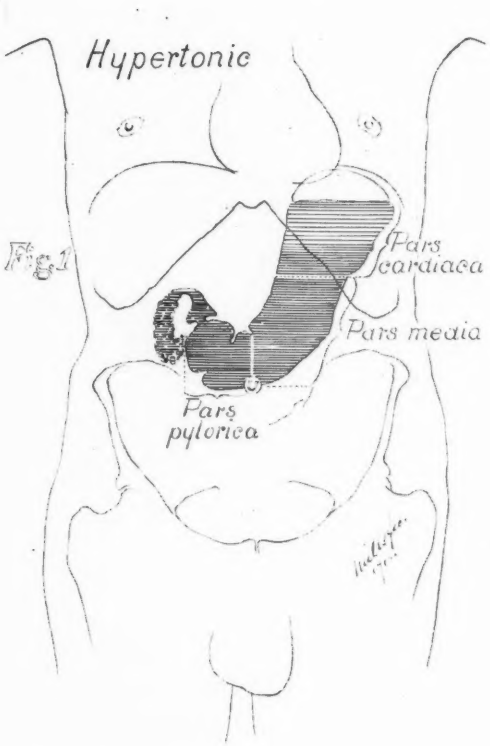

Fig. 1. Drawing from an individual case showing the hyper tonic "steer horn" stomach seen in men of markedly sthenic habitus. Showing also the divisions of the stomach as used in X-ray work.

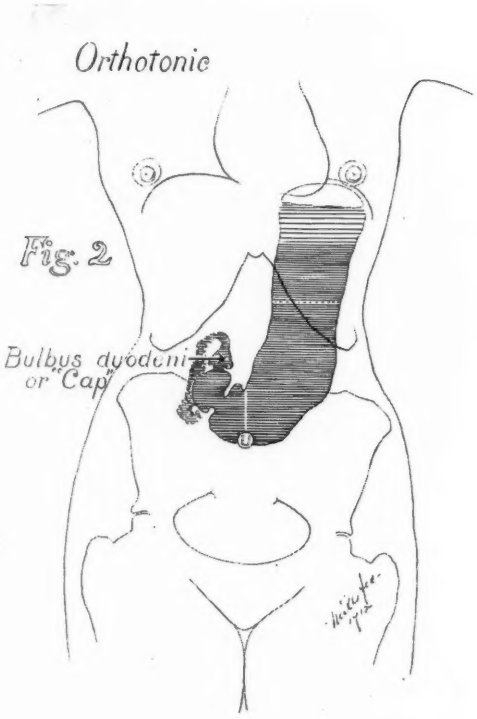

Fig. 2. Drawing from an individual case showing the orthotonic stomach occurring in men and women of normal sthenic habitus. Showing also the duodenal cap as formed by the contraction of the pyloric ring.

THE X-RAY ANATOMY AND PHYSIOLOGICAL DESIDERATA

It will be in order to speak of the form and position of the stomach as revealed by the X-ray to appreciate certain changes that occur as the result of ulcer. The X-ray has given rise to a new anatomy, the anatomy of the living, markedly different from that learned in the dissecting room, or at the operating table. In our discussion, the stomach will always be described as seen while the patient is standing, "the X-ray position." A prone or recumbent position alters conditions.

We have learned from the X-ray that the stomach during life is a pendulous elastic pouch (31) permanently supported at but two points, the cardia and at the arch of the duodenum, by the gastro-hepatic ligament; that it occupies in nearly all women and most men a far lower position and is more vertical as a whole than we had suspected (1, 21); that it is never larger than its contents, be they solid or liquid, and is not as a rule high in the abdomen, in large part covered by the ribs, as most textbooks and teachers of percussion would have us believe. We have come to appreciate that no organ or structure in the body is subject to such variations in form as is the stomach, not even the human face. There is no "normal stomach"—each individual possesses a stomach that fits his body. The living stomach as revealed by the X-ray is so different from our previous con-

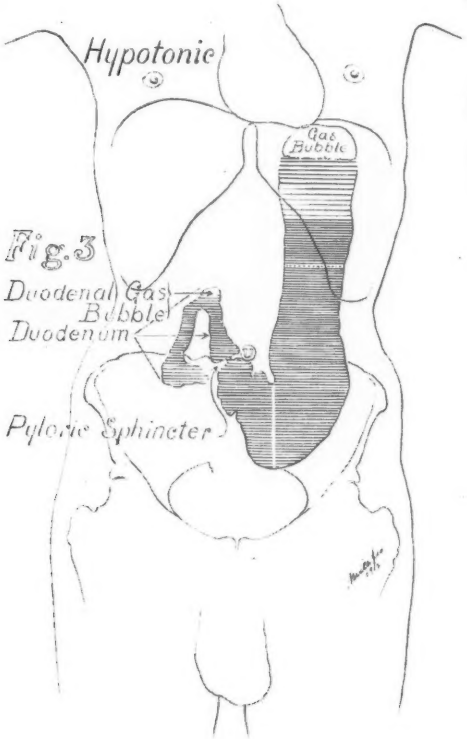

Fig. 3. Drawing from an individual case showing the hypotonic stomach occurring in those of somewhat asthenic habitus. Showing also the position of the duodenum, the trapped gas bubble at the arch of the duodenum, the transitory contraction of the pyloric sphincter and the fundus gas bubble or "magenblase."

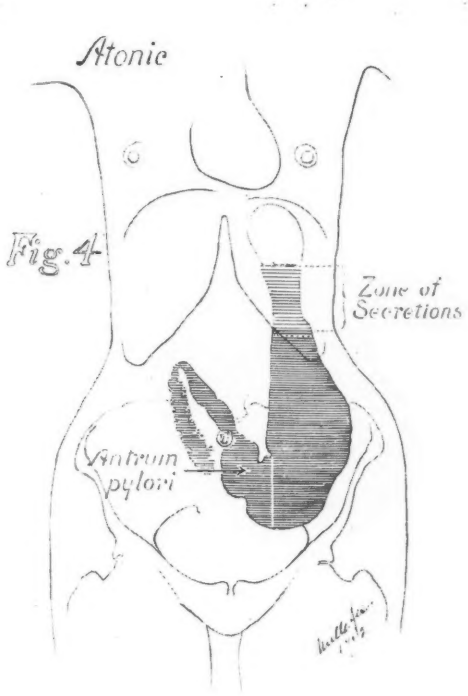

Fig. 4. Drawing from an individual case showing the atonic stomach seen in women of extreme asthenic habitus. Showing also the transitory antrum pylori and the segregation of fluid content (secretions) and bismuth bearing media.

ceptions that the use of an in part new nomenclature has become necessary for purposes of X-ray description. We therefore, following Schlesinger (6), classify stomachs as hypertonic, orthotonic, hypotonic and atonic. (Figs. 1, 2, 3, and 4.) As seen, this is a classification according to tonus. Tonus is a quality of contractility or resilience of living muscular tissue under normal conditions (7). It is to this tonus more than anything else that the form of the stomach is due (9). If powerful, the gastric tonus molds the ingesta to an expression of tonal pressure factors. If weak, the food mass gravitates to the pendant portion of the organ but little affected as to form by pressure of the gastric walls (7). In other words, in atony the food gives form to the stomach.

The type of stomach fits its owner; the hypertonic stomach accompanies powerful build and strength, the atonic occurring in those who are markedly so deficient or whose stomachs are the seat of pathological lesions causing atony; all intermediary forms occur. The form and position of the stomach then is dependent upon the habitus of the individual. In those of sthenic habitus, the hypertonic "steer horned" type or the orthotonic retort form is to be found. Figures 1, 2, 3, and 4 show different types of stomachs. Each drawing is an exact reproduction as to figure and stomach of an individual case. The stomachs

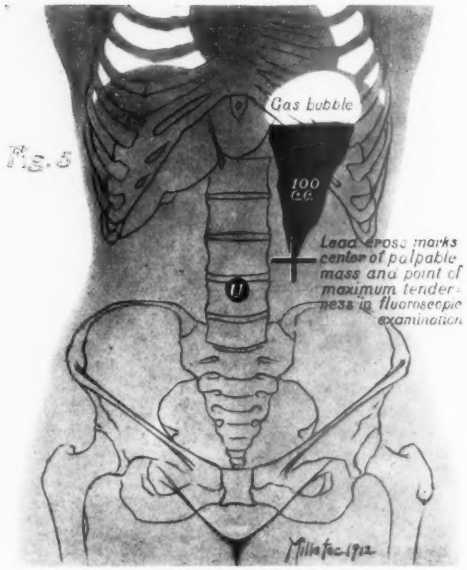
Fig. 5
Gas bubble
100 c.c.
Lead cross marks center of palpable mass and point of maximum tenderness in fluoroscopic examination
U

Fig. 5. Schematic drawing showing the delay in canalization. The bismuth is held up abnormally long in the pars cardiaca on account of localized ulcer evoked spasm of the circular muscular fibres at the ulcer level. The site is indicated by the cross; also shows the coincidence of palpable ulcer mass, point of maximum tenderness where there is irritation of the parietal peritoneum and X-ray ulcer evidence at the same point. Compare Figs. 8 and 30.

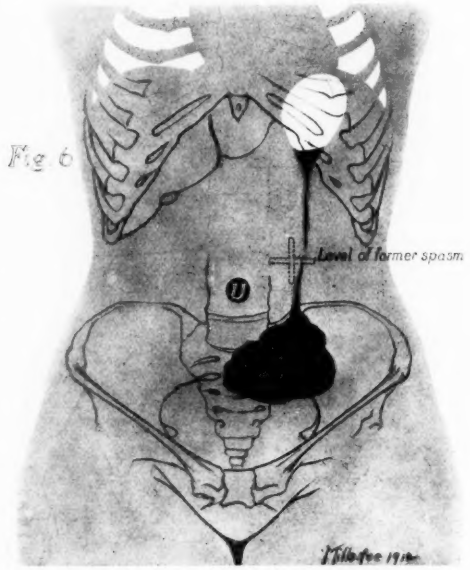

Fig. 6. Schematic drawing illustrating the sudden precipitation after suspension of the first few mouthfuls of the bismuth media on sudden relaxation of the localized spasm at the ulcer level. Also serves to show the canalization of an atonic stomach.

have been accurately corrected. In asthenia, the so-called "congenital enteroptosis," the atonic drain trap or hypotonic fish-hook form is present. (Figs. 3 and 4.) This relation of stomach to habitus is so constant that we may with confidence predict the type of stomach in a given case from the general physique. If it does not correspond there is at once raised a question as to its being normal. (Fig. 7.)

We have come for reasons of convenience to consider the stomach as visualized by the X-ray as divided into three portions, each representing approximately one third of that organ. These following His (45) are called the pars cardiaca, pars media, and pars pylorica. (Fig. 1.) The first two (pars media and cardiaca) constitute the vertical stomach, actually vertical in a majority of persons. The pars pylorica, smaller than the former divisions, joins them at an angle (1). (Fig. 1.) We have come to refer to the pars pylorica as the horizontal stomach. There are in the X-ray shadow anatomical divisions for these zones that need not be here considered (5). As a peristaltic wave reaches the distal portion of the pars pylorica this is nearly, though never completely (11, 13), shut off into a separate chamber, the antrum pylori. (Fig. 4.) The contraction of this through a continuation of the peristaltic wave presses the antral contents through or against the true pylorus. The distal boundary of the antrum pylori is the pyloric ring or sphincter. (Fig. 3.) Just beyond the antrum is to be seen transitorily a small triangular shadow, "the cap" (30), representing the first part of the duodenum or bulbus duodeni (25). (Fig. 2.) The differentiation of cap from antrum is effected by closure of the pyloric sphincter and occurs only during such closure. The stomach as a whole is always capped at its cardiac end by a collection of gas, the "magenblase" of the Germans. (Fig. 3.) This differs much as to size, which has little significance,

Fig. 7. Schematic drawing showing the arrangement of the bismuth meal in the extremely atonic stomach. In this instance also indicates the failure of visualization of an ulcer incisura on account of such atony, the bismuth being below its level. Compare with Fig. 8.

Fig. 8. Schematic drawing showing palpation with the gloved hand behind the fluoroscope whose object is to drive the bismuth media into the zone in which the incisura lies. Necessitated on account of atony. Compare Fig. 7.

and sometimes as to form, which may have much. (Fig. 22.) A much smaller gas bubble is frequently to be noted as trapped in the arch of the duodenum (Fig. 3).

If the passage into the stomach of the first six or eight mouthfuls of a bismuth bearing meal is watched, it will be seen, when tonus is good, that this small amount is held up in the pars cardiaca in the form of an inverted pyramid for a few seconds and then slowly progresses to the lower portion of the organ (7) as in Fig. 5. This is the normal delay to gastric canalization seen in the stomach having good tonus. If more bismuth be ingested the normal stomach will distend both laterally and longitudinally, especially the former, to accommodate the addition (24), but will always hold up its contents in more or less of a column. (Figs. 1 and 2.) An atonic stomach shows no tendency to arrange its contents in a columnar form: they seep downward unsupported to the lowest portions of the organ and there collect (7). (Figs. 6 and 7.) An appreciation of this phenomenon is essential in order to understand its variation that takes place in ulcer of certain locations.

The peristalsis of the stomach is a familiar phenomenon fluoroscopically; it is indicated by a bulging on the greater curvature that begins normally in the pars media and slowly progresses without essential change in form until the pyloric sphincter is reached (12). It may be likened in its progression to an oncoming breaker or the widening ring formed by casting a pebble into the water. Peristaltic waves occur normally about every 20 seconds (8, 27); they may be excessive, normal, deficient, or absent as to strength and frequency, in a given case.

At the expiration of from one and one half to six hours the normal stomach completely empties itself of the Rider bismuth meal (1). Gastric motility is controlled by the hydrochloric acid of the gastric juice and the alkalinity of the duodenal secretions (29), by peristalsis and by the form of the stomach. Peristalsis being chiefly dependent upon tonus (42), the form of the stomach being

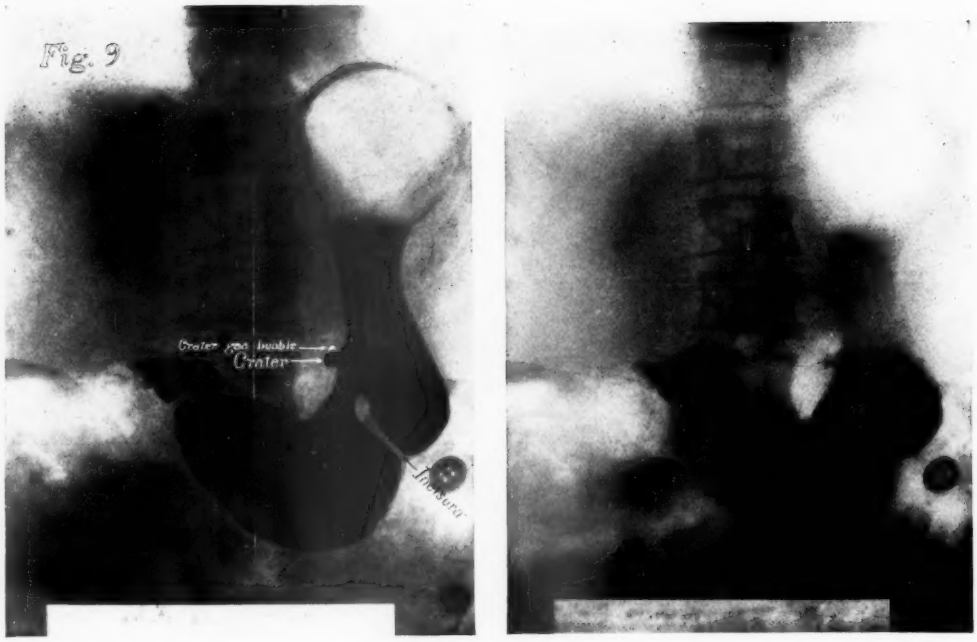

Fig. 9. Plate showing visualization of an ulcer crater and an extraordinarily deep incisura leading to the formation of a typical functional hour-glass stomach. Retouched (the same plate is also shown in the next figure not retouched).

also due to the same cause plus the individual conformation and regional capacity of the abdominal cavity (colon pressure, etc.) (40), it follows that the gastric motility is markedly influenced by the physique of the individual since the degree of tonus bears a direct relation to the habitus. Such is found to be the case. In those of sthenic habitus, individuals having hypertonic stomachs of high transabdominal position, the stomach empties itself quickly; in those of modified or asthenic type ("enteroptotics"), more slowly. In the latter the time of clearance may even exceed six hours.

THE X-RAY EVIDENCE OF ULCER PROPER

Ulcer of the stomach results in different X-ray findings, depending upon the portion of the stomach affected. Experience has shown that ulcer of the approximately vertical portions of the stomach, i. e., the pars cardiaca and pars media, give rise to similar pictures in contrast to those of the horizontal portion of the organ, the pars pylorica, and of which, by the way, unless obstructive our knowledge is much less exact. We have classified the evidence of gastric ulcer to be derived by X-ray examination primarily into changes in tonus, changes in position and form, changes in peristalsis and motility, and relations that restricted areas of pain, tenderness and mass bear to X-ray findings. These have been subdivided as shown by the general schema (pages 22 and 23).

I. *Changes in tonus resulting from gastric ulcer.* (A) When of the pars media or cardiaca, the vertical portions of the stomach, it may be suspected by changes in tonus resulting in (*a*) incisura, (*b*) delay in canalization, and (*c*) functional hour glass stomach.

(*a*) By an incisura we understand a sharp, narrow, usually quite deep indentation of the stomach lateral border opposite that curvature on which the ulcer occurs, caused by a sharply localized tonic spasm (34) of the circular muscular fibers of the stomach at the

Fig. 10. A double incisura caused by two ulcers at almost the same level in the pars media. On fluoroscopic examination a typical delay in canalization was observed and the vertical position characteristic of ulcer of the pars media. The somewhat oblique position here shown is due to strapping the abdomen with adhesive tape in order to drive the bismuth above the level of the incisura that the latter might be apparent on the plate.

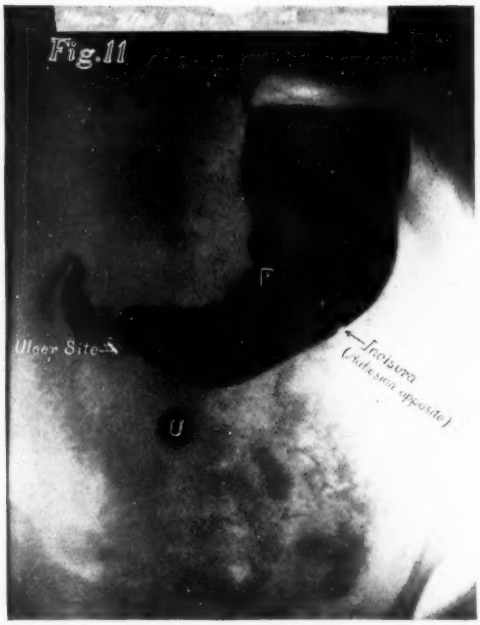

Fig. 11. Plate showing a tiny incisura opposite an adhesion on the posterior surface of the stomach; also a point of maximum pressure sensitiveness that falls within the gastric shadow, yet the ulcer being in a distant locality. Retouched.

level of an ulcer (18, 15, 16, 19, 17). (Figs. 9 and 10.) These spasmodic local muscular contractions are probably in some way evoked by special irritability of the ulcer. Each ulcer causes its incisura. Even when two ulcers are on almost the same level, the resulting defects in outline may preserve their individuality even when all but superimposed. (Fig. 10.) In this instance, operation showed two small ulcers on nearly the same level on the lesser curvature and posterior wall causing a sort of double incisura—the only case of the kind we have ever seen reported. Incisuræ may vary much in size though their form when evoked by ulcer or its sequelæ is approximately the same. They are blunt or finger-like indentations, their depth greatly exceeding their width, in contour sharp and regular. They may be so deep and commensurably wide as to nearly divide the stomach (Fig. 9), or not more than a centimeter (35) (Fig. 11) or even a few millimeters deep as shown in Fig. 11, the shallowest incisura we have seen reported. Almost invariably incisuræ occur on the greater curvature (4), as gastric ulcers are of course situated in the very great majority of cases on or near the lesser curvature. We have long been accustomed to associate the site of gastric ulcer with a certain saddle shaped area of limited extent on the lesser curvature and lateral walls of the stomach just before the pylorus. The X-ray examination will result in apparent, perhaps actual, extension of this area. Owing to the relaxation and lengthening occurring in all but hypertonic stomachs, this ulcer bearing area probably occupies in part the lower vertical lesser curvature, consequently incisuræ will be seen more frequently in the middle zone of the stomach than we would expect from their

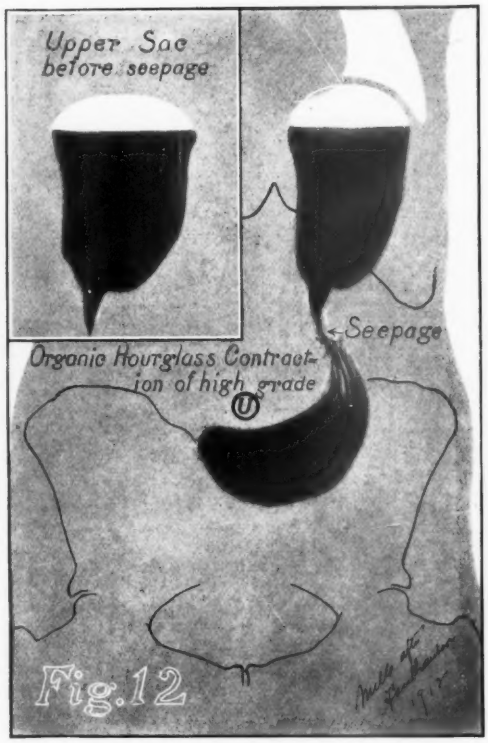

Fig. 12. Schematic drawing after Faulhaber of findings in organic hour-glass stomach of high grade. Note the central position of the connecting isthmus. The corner drawing illustrates the upper sac before the filling of the lower, which takes place slowly. Compare with the functional hour-glass stomach, Figs. 9 and 10, and of lesser organic contractures, Figs. 17, 19, and 25.

Fig. 13. Plate showing a pseudo-incisura that might be easily mistaken for genuine. Such filling defects are in most instances due to pressure of the rib margin, fæces or gas in the colon. At times they are inexplicable. Very slightly retouched.

situation as determined at operation and post-mortem. Incisuræ caused by ulcer result in a partial transverse division of the stomach (Figs. 9 and 10.) When such bioculation exists as the result of ulcer, the isthmus connecting the two divisions of the stomach thus formed will be eccentric with regard to the gastric longitudinal axis (16), in contradistinction to the condition obtaining in organic hour-glass stomach (4), (Fig. 12) and that resulting from carcinomatous ulceration (36). Emphasis was laid on the qualities of narrowness and sharpness of outline of ulcer incisuræ as viewed fluoroscopically, because other conditions lead to the formation of filling defects somewhat similar and it is of the utmost importance to properly interpret these atypical findings. Thus carcinomatous ulceration, unless on the basis of an old ulcer, may cause a broader, more irregular, less markedly finger-shaped indentation than does benign ulcer. A localized accumulation of gas—or more dangerously, an unvisualized extragastric tumor or fæces in the descending colon—may through pressure result in a spurious indentation. The pressure of the lower ribs where they cross the stomach frequently causes a pseudo-incisura (17). The plate giving greater refinement of detail is particularly instructive in clearing up such conditions, also as we have practiced is deep respiration on the part of the patient during fluoroscopic examination, causing the artefact to move with the diaphragmatically attached descending colon. Artefacts of such kind usually give other indications of their spurious

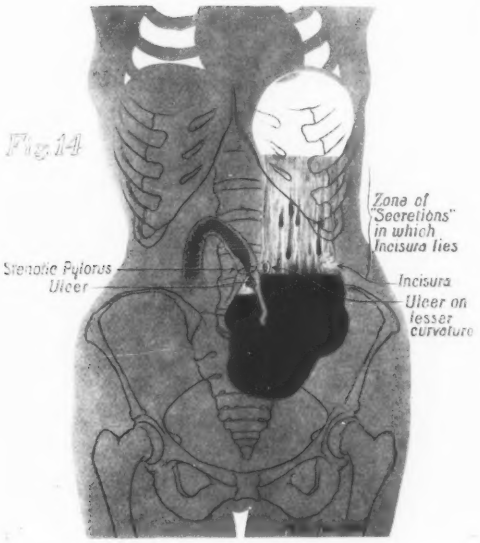

Fig. 14. Schematic drawing showing the position of the ulcers referred to in the legend of Fig. 15. Also illustrates the vertical position of the stomach typical of ulcer when occurring in the pars media and cardiaca. A large zone of residual "secretions" is present. Within this zone of secretions an incisura occurs due to an ulcer on the lesser curvature opposite. The incisura being above the level of the bismuth media indicates the necessity of palpation for its visualization. See Fig. 16.

Fig. 15. Plate showing dilatation with compensatory hypertrophy due to pyloric ulcer cicatrization. The stomach is very large, a true megalogastrium, yet lacking the central position of the non-compensating stomach. An incisura due to a second ulcer on the lesser curvature opposite may be seen within the zone of secretion above the level of the bismuth media. For further details see Fig. 14. Not retouched.

nature. They are of more obtuse angulation (Fig. 13); they lack permanence of location and form; above all, they do not survive vigorous palpation. More difficult to interpret is the incisura caused by an ulcer scar or perigastric adhesions (34). The incisura of ulcer scar seems as a rule more shallow than that of ulcer (35). Fig. 11 illustrates a shallow incisura due to a localized adhesion probably at the site of an old ulcer. All apparent incisuræ should be supported by an ulcer anamnesis, as is true of all X-ray evidence of ulcer (7); without, they must be overpoweringly suggestive to gain serious consideration.

Incisuræ may fail to appear fluoroscopically on account of insufficient intragastric pressure to stimulate them, or because the bismuth mixture is below the level of the ulcer and its resulting incisura, and so is not visualized. (Fig. 7.) This difficulty may be overcome by forcing the bismuth mixture by manual palpatory pressure upon the patient's abdomen while behind the screen into that zone of the stomach in which the ulcer lies. (Fig. 8.) Such a condition is usually due to an associated atony of the stomach. (Figs. 6 and 7.) Another cause of the bismuth being below the level of the ulcer incisura is that the stomach may contain fluid even though in a fasting condition, either in the form of a residuum in cases of motor insufficiency or its own excessive fluid secretion in some cases of "hyperchlorhydria." Such fluid, being lighter than the bismuth incorporated media, occupies the upper zones of the stomach (3), which, containing little or no bismuth, are invisible or nearly so. If now the incisura occurs within this area it will not be

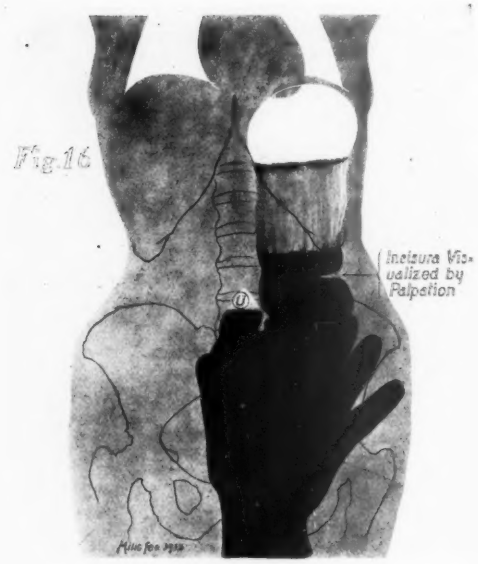

Fig. 16. Schematic drawing: the fluoroscopic palpation, which serves to visualize an incisura where the bismuth media is below its level on account of residual fluid in the stomach. Compare Figs. 14 and 15.

Fig. 17. Plate showing a decidedly probable organic hour-glass contracture (slight) in the pars pylorica or very low pars media (unconfirmed). The contracture is in part functional. Classical ulcer anamnesis including hæmatemesis. Retouched.

apparent fluoroscopically and be seen with difficulty on the plate. (Figs. 14 and 15.) This difficulty is also to be overcome by making palpatory pressure upon the patient's abdomen behind the screen, thus forcing the lower bismuth containing substance into the upper fluid containing but bismuth deficient zones. (Fig. 16.)

Incisuræ have been described as occurring ideopathically (18, 16). The possibility, of overlooking an ulcer, erosion, or scar at operation must be considered, especially if, as in this instance must be the case, no resection be done and the gastric interior be not inspected, palpation and inspection alone being relied upon for ulcer detection. Much has been written by German authors concerning intermittent local ulcer contractions, as indicated by transitory incisuræ, which are held in general to indicate simple ulcer or erosion (18, 16), in contradistinction to the more permanent incisura resulting from callous or florid ulcer (9). The view seems correct; certainly permanence adds to the probability of an incisura resulting from an active ulcerative process. Personally we are inclined to regard the occurrence of a typical ulcer incisura with ever-growing respect. We have never seen one in any but a case giving an ulcer history, nor had it fail when subjected to trial by operation, though it is true our experience has been limited. In two cases it indicated the existence and position of a second ulcer, and in one of scar (probably the site of a former ulcer) where their presence was unsuspected and would have been overlooked but for the X-ray evidence. Ulcer of the vertical stomach, however, may occur without an incisura.

There are two other changes of gastric tonus that are considered indicative of ulcer of the pars cardiaca and media; delay in canalization and functional hour-glass stomach, both resulting like incisuræ from localized spasm of the gastric muscular fibers at the ulcer level.

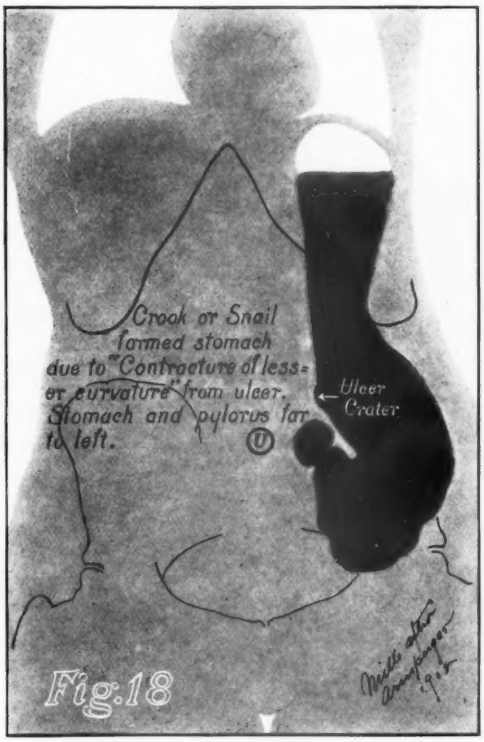

Fig. 18.

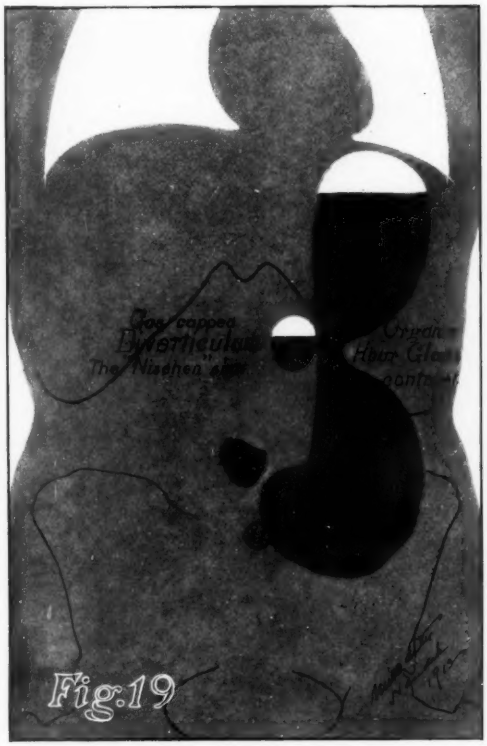

Fig. 19. Schematic drawing after Haudek illustrating X-ray findings associated with penetrating ulcer that has excavated a cavity in a neighboring organ, the "Nischen sign." The excavation is represented by the adventitious gas-capped shadow on the lesser curvature. Also shows a slight organic hour-glass contracture at the same level which accompanies penetrating ulcer in the majority of cases.

(*b*) By a delay in canalization we understand a marked pause in the descent of the first few mouthfuls of the bismuth media as it progresses from the cardia to the lower part of the stomach (19, 5, 7). (Figs. 5 and 6.) The first mouthful may not be delayed (4), suggesting that the local spasm is not extant in the empty stomach (19). Such delay must be due to similar localized spasm of the circular muscular fibers of the stomach, a condition that we know from our studies of incisuræ does occur as the result of ulcer of the pars cardiaca and media. The observation of delay in canalization is purely a method of the fluoroscope. It is our custom to instruct the patient to take "eight swallows" (about 100 cc.), and then cease until the arrangement of such amount in the stomach is noted. In estimating the genuineness and significance of a delay in canalization, there are a number of factors that are most important to bear in mind; above all, the influence which the type of stomach and the tonus that may be expected from such consideration has in each individual case. For example, in an individual of sthenic habitus with broad intercostal arch (Fig. 1), we may anticipate with confidence an hypertonic "steer-horned" stomach of a normally high degree of tonus. (Fig. 11.) In such a stomach the first few mouthfuls of the bismuth media will be normally held up for a number of seconds in the pars cardiaca, and such an occurrence is not suggestive. On the other hand, in asthenia we expect an atonic stomach.

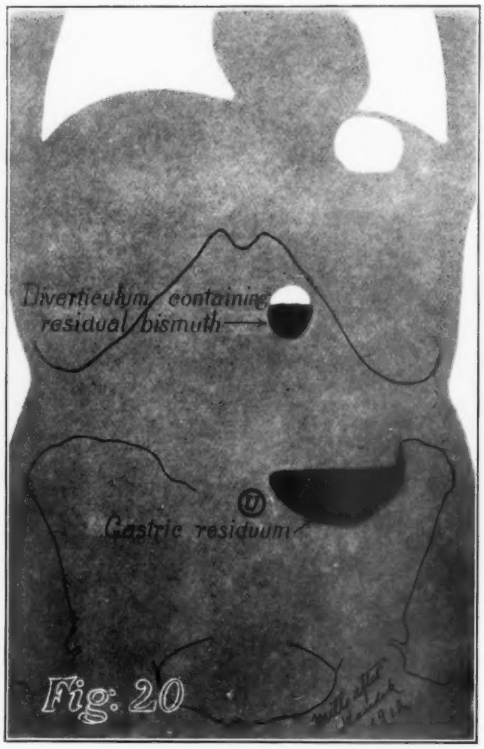

Fig. 20. After Haudek. Showing how a penetrating (excavating) ulcer diverticulum may retain bismuth after the contiguous part of the stomach is empty. Compare with Figs. 19 and 21.

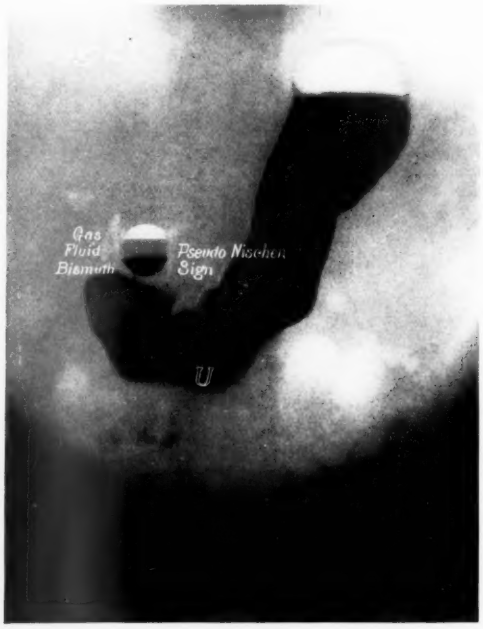

Fig. 21. Plate showing a pseudo-Nischen sign due to a collection of bismuth trapped between duodenal contractions (adhesions), secondary to pericholecystitis. The case illustrates the necessity of numerous examinations which in this instance cleared up the condition. The hadow of a large number of calculi in the gall-bladder is apparent on negative and print between the apparent diverticulum and the "21." It is doubtful if it will appear in the reproduction. Slightly retouched.

(Fig. 4.) Here the same delay in canalization would have significance, because we should expect immediate precipitation of the bismuth on account of deficient tonus. Again, the greatest care must be taken to prove that an apparent pause in canalization is not caused by extraneous factors, pressure by organs, tumors, gas or fæces filled intestinal loops, etc. The ulcer filling pause usually endures but a few seconds though it may last several moments, in the case depicted about one and one half. It is said to last at times much longer. A criterion as to the genuineness of a filling pause that knows no exception is that after suspension of a suggestive nature, the descent to the lower portion of the stomach must be sudden (7, 5, 4). (Figs. 5 and 6.) This is one of the chief differential points between the suspension due to local spasm and that resulting from organic obstruction. The sudden precipitation is of course suggestive of relaxation of the ulcer evoked spasm. A delay in canalization seems to occur only in cases where a permanent incisura is present.

(*c*) A functional hour-glass stomach we consider as one which exhibits in its filled form a permanent deformity of the nature of an incisura of such depth as to apparently divide the stomach into two compartments connected by an asymmetrically placed isthmus (16, 19) (Figs. 9 and 10.) It seems to us inadvisable to refer to all permanent incisuræ as resulting in the formation of functional hour-glass stomach regardless of their depth. To be classified as a functional hour-glass

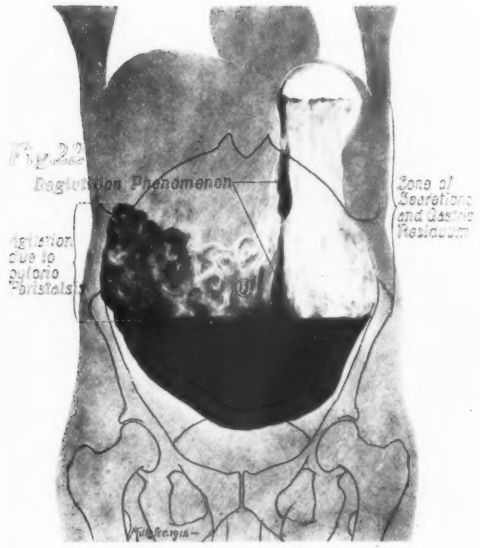

Fig. 22. Schematic drawing showing the enormous size globular form and especially the increase in the right median distance typical of high grade obstruction ectasy of ulcer origin. The presence of residual fluid (secretion or ingesta) and the deglutition phenomenon (the passage of swallowed bismuth through such zone) are also shown. To the right is indicated the unavailing antral peristalsis. Compare Figs. 23 and 24.

Fig. 23. Plate showing ectasia due to pyloric obstruction from ulcer cicatrization of low grade though uncompensated. Note the increase in the right median distance, also the formation of a duodenal cap which does not seem to occur in more marked obstruction. Not retouched.

stomach there should be an apparent bioculation of the stomach, this division amounting to at least one half the gastric diameter at its level. Associated with functional hour-glass stomach a delay in canalization may occur, followed by sudden discharge of the sustained contents into the lower portion of the stomach. Functional hour-glass stomach is an associate of callous and florid ulcer and apparently only occurs in the pars cardiaca and media, especially in the latter as is true of incisuræ. We have had two unconfirmed cases that seem to show incisuræ in the pars pylorica, one resulting in hour-glass-like contraction in part at least functional (Fig. 17); they are exceptional. Both gave typical ulcer histories, including hæmatemesis; neither showed X-ray evidence of ulcer elsewhere. We show one, but have no conclusions to offer. Care must be taken not to interpret a phase of antral peristalsis as an incisura resulting in hour-glass contraction. On the plate this is frequently seen to resemble the true incisura of the vertical stomach. The fluoroscopic examination only is of worth in such instances.

(B) Of changes in tonus resulting from ulcer of the pars pylorica nothing is known as yet.

II. *Changes in position and form of the stomach due to ulcer.* Knowledge of what we might call X-ray anatomy is an absolute essential to an appreciation of the changes in the position and form of the stomach resulting from ulcer. One should be thoroughly cognizant of the types of stomach to be expected in individuals of different habiti, of the X-ray pictures of hypertonus, atony and ptosis, of the relation which the different parts of the stomach and duodenum

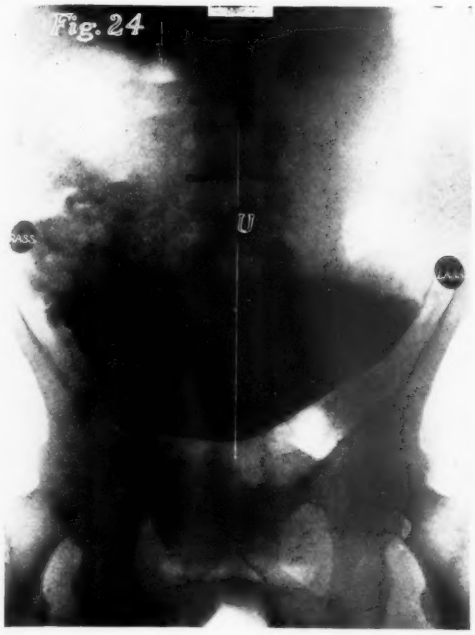

Fig. 24. Plate showing the central position and half moon formed arrangement of the bismuth media in the lower pole of the extremely ectatic stomach of high grade pyloric ulcer obstruction. Note the extension of the shadow in the right median distance. Very slightly retouched.

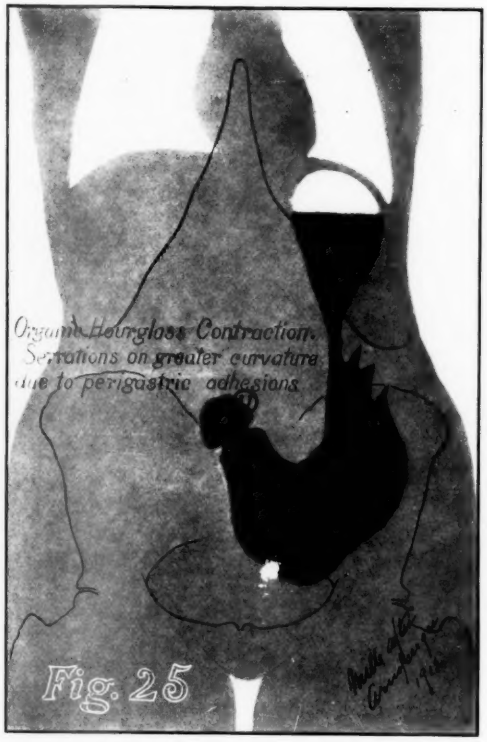

Fig. 25.

Fig. 26.

bear in different types of stomach, of the variations which the stomach may suffer from outside pressure factors and during the different stages of the gastric peristole.

Changes in position and form due to ulcer may occur as the result of (A) conditions arising within the stomach such as dilatation from pyloric obstruction or visualization of the ulcer crater, and from (B) causes originating without the stomach directly due to gastric ulcer, such as perigastric adhesions or attachment en masse of the stomach to other organs as the result of such.

(*a*) Changes in the *position* of the stomach, the seat of ulcer in its vertical portions from causes within the stomach. The stomach with an ulcer in the vertical portion is as a rule one occupying the left median half of the body (15); it is essentially vertical in so far as its upper zones are concerned, pars

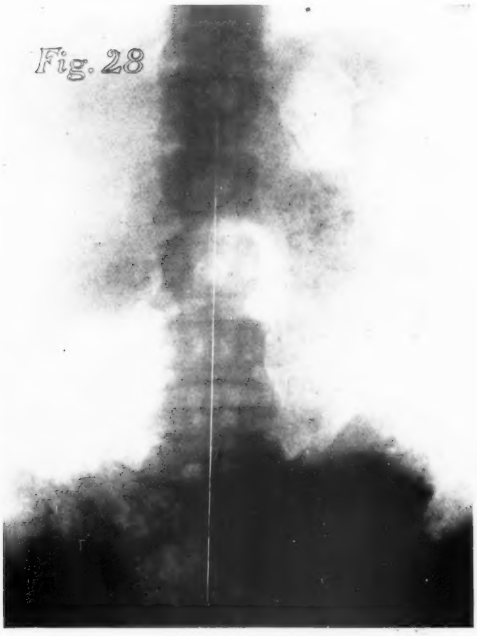

Fig. 28. Plate showing the left-sided position of a gastric residuum some time after the ingestion of the bismuth meal, when the ulcer is located in the vertical portion of the stomach. Very slightly retouched.

Fig. 29. A plate showing how far a markedly localized pressure sensitive spot may be from an ulcer. Also dilatation of the bulbus duodeni we believe from insufficiency of the pyloric sphincter when involved by an ulcer. Retouched.

media and cardiaca. (Fig. 9.)[1] An exception seems to occur in cases of functional hour-glass stomach of high grade, i. e., in which the incisura is of great depth and especially if located in the lower pars media. In such instances the lower sac may extend to the right and be of such form as to suggest a miniature dilatation. (Fig. 9.) It is possible that the local spasm results in enough of a stricture to add to the intragastric pressure of the lower ventricle when it is in peristalsis and so lead to its slight dilatation. The diagonal position (Fig. 1) is apparently not seen where ulcer of the two upper zones of the stomach is present, nor is the form of the stomach as a rule identical with that seen in asthenics in that it does not present the characteristic pouchlike outline of the "ptosed" stomach. (Fig. 4.) It seems possible that this vertical left-sided position may be due to an acquired atony secondary to hyperacidity, which as a rule accompanies ulcer; the atony being an expression of muscular fatigue caused by the physiological pylorospasm which occurs in cases of superacidity.

In addition to and associated with the vertical position of the stomach occurring in cases of ulcer of the vertical lesser curvature, another very interesting condition has been noted in many cases, that is, that the position of the bulbus duodeni is also frequently changed, being further to the left and often higher than is normal (10, 15). (Fig. 14.) This malposition of the first portion of the duodenum and pylorus, if extreme, gives rise to the "snail form stomach" of German writers. (Fig. 18.) Perhaps crook form would be more intelligible to us, the stomach being apparently sharply bent on itself at the junction of vertical and pyloric portions.

[1] In Fig. 10 the position of the stomach is altered by strapping the abdomen with adhesive in order to drive the bismuth media above the ulcer level that the incisuræ might appear in the plate; necessitated on account of extreme atony.

Fig. 30. A drawing from combined X-ray and operative findings of a given case (see Fig. 10) attempting to show the functional hour-glass stomach as it must exist in life but as it is never seen at operation or post-mortem. The drawing also indicates a perigastritis found about the ulcer site and adhesions from it to the abdominal wall proving parietal peritoneum irritation. In this case the X-ray evidence of ulcer (incisura) corresponded to a definite pressure sensitive point.

This left-sided position of stomach and cap is graphically shown in the position of the gastric remnant several hours after the administration of the bismuth meal, which is distinctly to the left. (Fig. 28.) It is by no means to be inferred that this crook form stomach with pylorus to the left is to be found in all cases of vertical lesser curvature ulcer, still if present it is of diagnostic worth; if not, it only relatively militates against a positive diagnosis. No entirely satisfactory explanation has been offered of the phenomenon so far as we can learn. Authors speak of it being due to "longitudinal shrinkage" (4, 38); as a "drawing in of the lesser curvature" (22); by others as being due to adhesions, etc. (10), doubtless true in high grade conditions. It is hardly necessary to say that a left-sided dislocation of the stomach and pylorus may be caused by other conditions than ulcer, as from pressure of an enlarged liver. Carcinoma strictly localized in the pyloric portion of the stomach gives, as Haudek has pointed out (15), a somewhat similar picture especially if there be obliteration of the pars pylorica.

Of changes in *form* arising from causes within the stomach and resulting from ulcer of its vertical portion three most interesting pathognomonic signs have been described within the past two years. The crook-shape, left, laterally-displaced stomach and pylorus were just discussed under changes in position and is not included. The three referred to are the visualization of the ulcer crater—a phenomenon associated with penetrating ulcer, the so-called "Nischen symptom" (22), and the X-ray manifestation of organic hour-glass stomach. With one exception they are all evidences of ulcer of the vertical portions of the stomach, pars cardiaca and media, the Nischen symptom of penetrating ulcer being found uncommonly in ulcer of the pars pylorica (16, 28).

The outline of the bismuth-containing stomach represents but the projection on plate or screen of its maximal lateral diameters. A hand held between a light and the wall casts a shadow representing the contour of the obstructing mass in the same manner. If now there be any sharply localized peripheral addition to this obstructing mass it must of necessity show as a projection on the margin of the shadow. An ulcer crater may thus become visualized through virtue of the bismuth it contains (19, 4, 22), provided the ulcer be situated on the periphery, as the stomach is viewed from the front, or it be possible to turn the patient so that a tangential view (17) may silhouette the outline of the crater. Fig. 9 shows such a crater visualization. The position of the crater is suggested by the presence of the extraordinarily deep incisura leading to the formation of a characteristic functional hour-glass stomach. The crater in this instance is especially finely shown on account of an accidental accumulation of intestinal gas behind it. A tiny gas bubble is to be seen caught in its upper zone, a phenomenon also observed by Haudek (35). Such a crater need be no more than a few millimeters deep to be recognized (35, 4). An apparent crater phenomenon must be subjected to the closest scrutiny not only as to the character of the projection but especially as to form and site at subsequent examinations.

Of the two other positive X-ray indications of ulcer of pars cardiaca and media mentioned, i. e., those associated with penetrating ulcer and organic hour-glass stomach, we can show no plates as we have never had the good fortune to examine cases which have been confirmed. They are both quite rare but are thoroughly well established and proven ulcer indications. For the sake of completeness they are reviewed from the work of others, Haudek (14), Faulhaber (19, 4), and Reiche (20, 23). If an ulcer gradually penetrate, the gastric wall may at such site become protectively adherent to a neighboring organ or structure thus exposing unprotected tissue to the action of the gastric digestants. As a result a pocket may be excavated in the adherent organ. Such penetrating ulcers are occasionally found at autopsy (39). Haudek (15) has especially emphasized the following X-ray findings associated with the condition. When filled with bismuth the X-ray will show such a diverticulum as a small circular shadow without the main intragastric mass and connected to it by a narrow isthmus of varying

length. A gas bubble is as a rule trapped in the upper zone of such a pocket. (Fig. 19.) After the stomach is empty such a pocket usually still contains bismuth. (Fig. 20.) During fluoroscopic palpation the bismuth in the adventitious cavity cannot be affected by manipulation, though it usually can be stripped from the contiguous portion of the stomach. The length of the isthmus connecting the pocket with the stomach may be only the thickness of the gastric wall, or several centimeters in length, in which instance it represents a sinus burrowing through resistent scar tissue. The liver is most commonly the seat of penetrating ulcer (16), the pancreas probably next in frequency (14). Difficulty may be experienced in differentiating such diverticulæ from duodenal bismuth masses, also often capped by a small gas bubble. To illustrate how confusing such a duodenal remnant may be, we may cite the case of an individual whose history might be interpreted as indicating chronic ulcer. In plates taken at the first X-ray examination a perfect penetration diverticulum was apparently to be seen surmounting the pars pylorica, suggestive in size, circular, surmounted by a gas bubble, and even showing sedimentation of the contained bismuth mixture, indicating some permanence. (Fig. 21.) Certain features on other examination, lack of uniformity as to size and shape, and absence of respiratory excursion in common with the liver, indicated its being a pseudo-Nischen symptom, and such it proved to be. At operation no evidences of a penetrating ulcer were found; heavy duodenal adhesions at two points accounted for the fact that bismuth was caught in the duodenum between them. In the differential diagnosis of duodenal mass and true "Nischen sign," the rule is to identify both the duodenal gas bubble and that of the diverticulum (5).

There remains to be considered those changes in form, manifested by the X-ray, occurring in organic hour-glass stomach. Organic hour-glass stomach, so far as we have been able to learn, has never been proven as a result of ulcer of the pars pylorica, though conceivable as a result of ulcer there situated. (Fig. 17.)

Organic hour-glass stomach implies a more or less median constriction of the stomach as a result of the contractures of callous ulcer and associated processes. The X-ray picture resulting might be imagined as that of two small atypical gastric ventricles connected by an isthmus. While this is true late in the examination and in slight contractures, it is not immediately the case where the condition is marked. Usually the X-ray manifestation on immediate fluoroscopic examination or in plates taken shortly after the administration of the bismuth mixture is that of a single bismuth mass situated high in the abdomen, the proximal sac, atypical in its lower contour, showing no tendency to turn toward the right (7). (Fig. 12, corner drawing.)

Other conditions are conceivable as capable of causing simulating phenomena. We have had a case of involvement of the median stomach by syphilitic gumma operatively confirmed that gives a typical hour-glass retention in the upper sac. Fig. 17 probably shows a slight organic contraction. In organic hour-glass stomach of ulcer origin, a lower bismuth mass will later be seen to form slowly, representing the lower sac. A characteristic of organic hour-glass stomach of high grade is that this filling of the lower sac takes place slowly by seepage (19, 7). (Fig. 12.)

(*c*) Of changes in (1) position and form due to intragastric causes when non-obstructing ulcer of the pars pylorica is present, nothing is definitely known. In common with non-obstructive ulcer of other locations the stomach shows a degree of atony often unexpected from a consideration of the patient's habitus. (Figs. 6 and 7.) This atony probably is caused by retention due to pylorospasm in turn secondary to hypersecretion or hyperacidity. Rarely a penetrating ulcer gives rise to a Nischen sign; the diverticulum above the pars pylorica and within the liver (16, 28).

(2) If the pyloric lumen is markedly obstructed by callous ulcer or cicatrix, characteristic changes occur if there be no compensatory hypertrophy of the gastric walls; namely a central position, an increase in the lower transverse diameters of the stomach, and

especially extension to the right of the median line (37, 16). (Figs. 22 and 23.) This median position of the ectatic stomach is graphically shown in the position and form of the gastric residue, median in position and crescentric in outline (15, 4). (Fig. 24.) In extremes the form and position of the stomach is only limited by the walls of the abdominal cavity. (Fig. 22.) In extreme uncompensated pyloric obstruction from ulcer cicatrization enough bismuth may not escape from the stomach at a time to form a duodenal cap, though this is not true of the lesser grades. (Fig. 23.) In certain cases even in compensated obstruction instead of the sharp transverse terminal shadow caused by the contracted sphincter, we may have a conical distal termination of the shadow of the pars pylorica representing the narrowing lumen. (Figs. 14 and 15.) The normal condition is shown in Figs. 1, 2 and 3. (3) In case there be an adequate compensatory hypertrophy following ulcer obstruction, the stomach certainly in some instances resumes approximately its normal form and proportions though still dilated as shown in Fig. 15. In this case as indicated by the drawing two ulcers were present, one in the pars media, the other obstructing the pylorus. (Fig. 14.) The stomach compensated fairly well, as shown by a small residuum after six hours. (Fig. 28.) Its form and position is that of an unobstructed though very large stomach, a true megalogastrium, dilated but compensatorily hypertrophied. At operation the gastric walls were found about three times as thick as normal. An interesting feature of obstructive ectasy that may often be observed fluoroscopically is that the presence of fluid in such a stomach, either retained secretions (Fig. 14) or residual ingesta, can be detected before or during the ingestion of the bismuth media. Before, by the half moon shape of the gas bubble whose lower border represents the surface of the residual fluid; later, by the fact that the separate swallows of bismuth drop to the lower portions of the stomach in isolated "blobs like tar through water" (7) — the deglutition phenomenon (Fig. 22).

(B) Changes in form from extragastric conditions resulting from ulcer are hardly separable from changes in position, nor can we classify according to which portion of the stomach is involved. Perigastric adhesions most generally modify the position and form of the stomach in common. In some instances, however, (*a*) localized changes in outline have been described without essential change in position by Clairmont and Haudek (28), and Arnsperger (5). In their cases perigastric adhesions resulted in local serration of the gastric border, in both instances the greater curvature. (Fig. 25.)

(*b*) Changes in position as a whole arising from processes without the stomach due to ulcer are limited to the results of ulcer perigastritis, and consist of those malpositions resulting from extensive adhesion of the stomach to neighboring structures. The most common attachment seems to be that of the stomach to the under surface of the liver (16). Fig. 26 possibly shows such a condition though unconfirmed. The patient gave a classical ulcer anamnesis. A discrepancy between the high position of the stomach so adherent and the habitus of the individual may be suggestive.

Most careful scrutiny is necessary before reaching such conclusion to eliminate the possibility of malposition arising from extragastric pressure factors, especially a distended colon.

III. *Changes in peristalsis and its resultant motility or clearance.* When X-ray studies of the human stomach were first made, the peristalsis as a very apparent phenomenon became at once the object of investigation with the hope of its being utilized for diagnostic ends. Less has resulted from such efforts than in the case of any other of the gastric phenomena. There are few inferences that we can as yet draw from its variations; such as there are, are chiefly connected with obstructing ulcer of the pylorus. The same to a considerable degree is true of motility, though certain of its variations are decidedly helpful.

(A) Changes in peristalsis and motility without pyloric obstruction. It has been proven by Pavlov and his school that the cause of closure of the pyloric sphincter is the

presence of hypochloric acid in the first portion of the duodenum, and that this remains closed until this duodenal acid content is neutralized by the pancreatic, hepatic and intestinal secretions (29). So we should expect in hyperacidity or hypersecretion, which usually accompany ulcer, delay in motility as a result of prolonged sphincter contraction; at the same time, increased peristalsis on account of the pyloric obstruction thus offered.

As far as the motility is concerned, it is true that a gastric residuum after six hours without other adequate cause adds to the probability of ulcer being present (44, 33); in the case of hyperperistalsis less apparent. A discussion of why this is true would at present lead us too far afield. About all we can say is that when we see an exaggerated peristalsis it somewhat adds to the probability of ulcer being present, delayed clearance decidedly more so.

Antiperistalsis, a peristalsis in which the waves progress toward the cardia, has been described as an uncommon manifestation of non-obstructing ulcer of the pars pylorica by Haudek (32), and more frequently met with in pyloric obstruction. It is not common. In the cases observed by us, peristalsis has always originated at or below the ulcer level if indicated by an incisura even where this is quite low in the vertical stomach.

So far as ulcer is concerned, delayed motility indicates either an organic pyloric obstruction or delayed clearance from non-compensated hyperacidity or hypersecretion; i. e., relatively inadequate alkalinizing secretions. As to whether a delayed motility is due to organic or functional obstruction the clinical findings and the degree of retention must indicate. However, from an X-ray standpoint, the fact that the stomach does or does not extend suggestively far to the right of the median line (Fig. 23) may speak for or against an organic obstruction; though in the milder grades of organic stenosis or where compensated we may not have a right median increase. (Fig. 14.) We have already called attention to the fact that certain asthenics show a delayed motility on a six-hour test, which should be borne in mind in reaching a conclusion. Again, some cases of organic pyloric obstruction do not even show a delayed clearance on a six-hour X-ray test (compensatory hypertrophy). If a non-obstructive ulcer involve the pyloric ring we are strongly under the impression that it may result in its incomplete closure (insufficiency), at least until the onset of the acid evoked pylorospasm. This implies a belief in a mild tonic closure of the pylorus (43), at least when food enters the stomach (13). In the case from which Fig. 29 was taken the duodenal cap filled with every gastric peristole and the first part of the gastric clearance was exceedingly quick; after a time this ceased, and at the end of six hours the stomach contained a small residue (true pylorospasm). The plate shows the cap dilated, its under lip pouching, the only one of seven to do so. Operation disclosed a small ulcer directly in the pyloric ring with the first portion of the duodenum markedly dilated. (It is possible that the over prompt and illogical [hyperacidity present] initial clearance in duodenal ulcer may be due to the same cause.)

(B) Ulcer of the pyloric portion of the stomach if resulting in obstruction may manifest itself by most marked hyperperistalsis at some time during gastric digestion, beginning high in the stomach and characterized by increased size in the peristaltic bulgings and the fact that two or three such peristaltic waves may be in progress at the same time. This hyperperistalsis is often not observable until some time after the ingestion of the bismuth media. Such peristalsis represents the effort of the stomach to overcome the pyloric obstruction. One of our cases (Fig. 22) illustrated well a type of peristalsis occurring at times in pyloric obstruction, a peristalsis limited to the extreme pyloric portion (5). It was indicated not only by the changes in form of the pyloric gastric wall but by the sharply limited commotion in the bismuth media at such locality, as seen fluoroscopically. Antiperistalsis originally described by Jonas (26) is said to occur much more frequently in cases of pyloric ring obstruction than where the ulcer is in the pars pylorica yet non-obstructing; still it is far from common.

If ulcer of the pylorus or its cicatrix be so situated as to cause organic obstruction, most amazing changes in the gastric clearance occur as shown by examination at intervals of an hour or two after ingestion until the gastric contents have passed through the pylorus or are vomited. An ectatic stomach may retain a considerable amount of bismuth for many hours—8 to 24 or longer. A plate taken six hours after the bismuth ingestion will graphically show the amount of retention, the retained bismuth occupying a median position. (Fig. 24.) In this connection we may again interpolate the caution which if not observed will lead to disastrous results, that some asthenics (enteroptotics) show a bismuth remnant after six hours; a type of individual who may present clinical symptoms suggestive of a slight pyloric stenosis, in reality of functional origin, and so further endanger the diagnosis.

We must thoroughly grasp the fact that the gastric clearance is to be anticipated by the physique of the individual. A point of differential diagnostic value as between organic obstruction, and delay in clearance due to anomalies of tonus and form, is that without organic obstruction the stomach will empty itself much more quickly when the patient lies upon the right side. If the obstruction be organic, posture has no effect on the time of clearance (41).

THE RELATION OF POINTS OF PAIN, TENDERNESS AND LOCAL MASS TO X-RAY FINDINGS

The X-ray will be a potent factor in deciding certain questions as to the relation that localized visceral lesions bear to points of pain and tenderness. The stomach and duodenum being readily identified and comparatively immobile are peculiarly suited for such studies. Pressure-sensitive points and localized voluntary pain can scarcely fail to be of diagnostic import either positively or negatively if deductions from such observations are controlled by lessons to be learned from special investigations that are available. Without such control, deductions will surely be most misleading and dangerous.

Ulcer of the stomach may exist and in conjunction with it a localized pressure-sensitive point. If such a spot be present it may fall entirely without the X-ray shadow of the stomach and at the same time no other cause than ulcer be present to account for its existence. (Fig. 29.) A definitely localized pressure point may exist that falls within the gastric shadow, yet operation reveal an ulcer in a distant locality. (Fig. 11.) The tender point may coincide with the site of an ulcer as determined by the plate or screen, and subsequently at operation ulcer be found in a corresponding situation.

Yet we know while this is true when the stomach is perhaps moderately full, it cannot be the case when it is empty and collapsed or when overdistended, yet the painful locus is always the same. It is the explanation of such everyday findings that we must attempt before essaying their utilization for diagnostic ends.

Certain physiological teachings will aid us in understanding the relation that pain and points of tenderness bear to gastric ulcer. The pain and tenderness due to gastric ulcer may originate from any or all of three causes. First, (a) the general unlocalized pain occurring at definite times after meals is due to intragastric hypertension plus special irritability of the ulcer (46). This is the only type of pain that a hollow viscus like the stomach can experience (50). An uncomplicated ulcer is not intrinsically painful or sensitive, as an ulcer on one's finger is (49). Such pain due to hypertension is worthless as an X-ray diagnostic possibility because unlocalized. Second, (b) gastric ulcer may cause a localized area of pain or pressure sensitiveness as the result of a reflex (47, 48). The exposed afferent nerve endings in the ulcer floor are irritated. These nerves transmit impulses to the cord by way of the posterior roots; such pass out by way of the anterior roots. Head and Holmes' recent work (53) has shown that the localization of pain is centered in the basal ganglia, hence we may say that the brain determines the definite locus of tenderness in the abdominal wall. This area need not be, and usually is not, directly over the ulcer. The occurrence of an area of

General scheme of article. The figures and letters marking the various headings and subdivisions correspond to those in the text.

- INTRODUCTION
  - Necessity for co-operation of clinician and Röntgenologist
  - The X-ray gastric anatomy and physiological desiderata. Form, types, divisions, tonus, peristalsis, motility.
- X-ray evidence of gastric ulcer proper
  - I. Changes in tonus
    - (A) Due to ulcer of the *vertical portion* of the stomach (pars cardiaca and media)
    - (B) Due to ulcer of the *horizontal portion* of the stomach (pars pylorica)
  - II. Changes in position and form (knowledge of X-ray anatomy essential)
    - (A) Changes in position and form due to *intragastric* causes resulting from ulcer
    - (B) Changes in position and form due to *extragastric* causes resulting from ulcer
  - III. Changes in peristalsis and motility (general and physiological observations)
    - (A) *Non-obstructing* ulcer
    - (B) In *uncompensated* pyloric *obstruction* from ulcer cicatrization
  - IV. Relation restricted areas of pain, tenderness and mass bear to X-ray findings (observations on peristalsis)
    1. Stomach suited to such studies
    2. Necessity for care in deductions
    3. Possibilities as to relation of pressure-sensitive loci to stomach shadow.
    - (A) Causes of ulcer pain
    - (B) Ulcer mass.

- (a) Incisuræ
  1. Definition
  2. Cause
  3. Specificity
  4. Size, form and location
  5. Eccentric division of stomach resulting
  6. Pseudo-incisuræ
  7. Criteria of genuineness
  8. Cause of non-appearance
  9. Ideopathic incisuræ
  10. Diagnostic value of incisura
- (b) Delay in canalization
  1. Definition
  2. Cause
  3. Technique of observation
  4. Criteria of genuineness (influence of habitus)
- (c) Functional hour-glass stomach
  1. Definition
  2. Criteria of
  3. Associate of callous ulcer
  4. A delay in canalization associated with functional hour-glass contraction
  5. Functional hour-glass contraction only in vertical stomach.
- Nothing definitely known, possibility of incisuræ
- (a) Where ulcer in the vertical stomach (p. card. and p. med.)

  Position
  1. Left median as a whole (vertical as to p. card. and p. med.) (exception)
  2. Diagonal position not seen
  3. Causes
  4. Median position of bulb. duo.
  5. "Snail Form" the extreme
  6. Left median position of bulb. Duodeni not invariable
  7. Left median position may be due to other causes

  Form
  1. Crater visualization
  2. Nischen sign of penetrating ulcer
  3. Pseudo Nischen sign
  4. Organic hour-glass stomach
- (b) Where ulcer in the horizontal stomach (p. pylor.)
  - [1] Non-obstructing
    - *Position*: Nothing known — Second atony the rule
    - *Form*: 1. Occasional Nischen sign of penetrating ulcer
  - [2] Obstructing and non-compensated
    - *Position and Form*: 1. Central as a whole (extension to right); 2. Central position of residue
  - [3] Obstructing and compensated
    - *Position*: 1. No change as a whole
    - *Form*: 1. Not characteristic as a whole; 2. Form of terminal pyloric shadow may indicate stenosis
- (a) Localized adhesions (serrations)
- (b) Unlocalized attachments en masse to other organs or structures

Peristalsis
1. Hyperperistalsis may add to diagnosis
2. Antiperistalsis in ulcer of p. pylor.
3. Peristalsis originates below incisura

Clearance ("Motility")
1. Delayed due to hyperacidity
2. Criteria as to whether due to organic or functional obstruction
3. Influence of type of stomach (and habitus) must be considered
4. Pyloric insufficiency from non-obstructing ulcer.

Peristalsis
1. Hyperperistalsis characteristic (double or triple waves)
2. Type of peristalsis restricted to pars pylorica
3. Antiperistalsis

Clearance ("Motility")
1. Great delay in clearance
2. Delay commensurate with degree of obstruction
3. Unaffected by posture

- (a) Hypertension (intragastric)
  1. Cause of general pain after meals. Useless as X-ray possibility because unlocalized.
- (b) Due to reflex
  1. Causation
  2. Does not necessarily correspond with ulcer site (analogy of McBurney's point)
  3. Gastric ulcer not intrinsically painful
  4. Possibility of correlating pressure-sensitive loci and X-ray findings
- (c) Due to irritation of parietal peritoneum
  1. Parietal peritoneum can localize irritation
  2. Symptoms of perigastritis usually indicate parietal peritoneum irritated
  3. If perigastritis present tender point usually overlies ulcer. Adds to X-ray evidence if corresponds
  4. If no symptoms of perigastritis sensitive point probably reflex.

1. Of value if corresponds to X-ray findings, especially if symptoms of perigastritis present
2. If does not correspond to site indicated by X-ray, not pressure-sensitive, and no symptom of perigastritis is not due to ulcer.

maximum tenderness in appendicitis, McBurney's point is analogous. It is not necessarily over the appendix, (52). There is a hypersensitive reflex locus in the abdominal wall. Can we use such localized points of tenderness which undoubtedly occur in gastric ulcer in conjunction with the X-ray for diagnostic ends? If uncomplicated ulcer in a certain location always gives rise to tenderness of a certain area, as in appendicitis, this may be possible. The third type of pain originating from gastric ulcer is due to (c) irritation of the parietal peritoneum by perigastritis secondary to ulcer (16, 4). The parietal peritoneum, or rather nerves in the subperitoneal connective tissue (46), can definitely localize such an irritation (49). If then we have symptoms of perigastritis, that is, sensitiveness to jarring or motion (51), also a point of marked tenderness, this point probably overlies the ulcer. It is usually found to do so. If such conditions then exist, and the point of tenderness registers with that site indicated by the X-ray as being the seat of ulcer, it adds positively to such presumption; if it does not correspond, it detracts.

If a pressure-sensitive point be unaccompanied by symptoms of perigastritis, and especially if it fall without the shadow of the filled stomach as is usually the case, it should be considered as reflex; and, in the light of our present knowledge, of very limited diagnostic value, as many other intra-abdominal conditions give rise to similar tender points. A number of writers claim, without adequate evidence, a relation between pressure-sensitive points and ulcer which is not warranted on physiological grounds. Thus they describe the tender point as rising and falling with respiration and its correspondence with a site indicated by the X-ray as being corroborative; or the falling of a pressure-sensitive spot within the gastric shadow as indicative of an underlying ulcer. This, in our opinion, is not in accordance with the facts.

There is at times a palpable mass of suggestive nature and location encountered in ulcer cases. If such mass corresponds to an "X-rayically" suspected site in the stomach, it is of positive value especially if there be also clinical evidence of perigastritis, as an inflammatory ulcer mass of palpable size will almost surely be associated with a perigastritis resulting in an associated superficial point of tenderness from parietal peritoneal involvement. (Fig. 5.) A mass that does not correspond to an indicated site or tender point is almost surely not of ulcer origin. Fig. 30 shows an area of perigastritis caused by ulcers of the pars media. Irritation of the parietal peritoneum is proven by the adhesions connecting the ulcer site to the abdominal wall. In this instance a definite pressure-sensitive point, also painful on motion and jarring, exactly corresponded with a delay in canalization, incisuræ and a palpable mass. (Fig. 10.) The drawing (Fig. 30) also shows the functional hour-glass stomach resulting from spasmodic ulcer contractures as it must occur in life though it is not seen at operation or post-mortem.

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PROBLEMS OF OBSTETRICAL PRACTICE[1]

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IT was in 1850 that Dr. James P. White of Buffalo inaugurated clinical methods of teaching in obstetrics, so that in America practical instruction in this great art is some seventy-two years old.

During this three quarters of a century the report is one of progress both in our knowledge and in our skill; nevertheless, obstetrics to-day still deserves but a small measure of congratulation. In the great race of progress it continues to run a bad third with medicine and surgery.

Assuredly parturition is rightly enough to be regarded as a physiological process — in Sir J. Halliday Croom's telling phrase, "a physiological process identical in the countess and in the cow" — but its results in death and disablement render it frequently of the nature of a pathological calamity. The price of motherhood is still cruelly high. And though a part of this high price may be charged to the depraved social conditions of luxury and indolence, to poverty and overwork, to social wear and tear, by far the larger share must be underwritten by the medical profession. Who but ourselves are to blame if in Canada and the New England states some five hundred women each year die in childbed and some five thousand more are therein more or less permanently disabled, when we remember that a full three quarters of this number are the victims of septic infection, so often the technical euphemism for medical carelessness or neglect. Where practice is admittedly ignorant or imperfect, the training is, without question, at fault. Let us frankly acknowledge it, that the fault in the practice of obstetrics is with our teaching, or our want of teaching. In part, too, I exonerate the teachers, for the subject, for obvious reasons, is extremely difficult to teach.

Accordingly, it is no surprise that barely one half of our one hundred and twenty medical schools are pronounced as "acceptable" by a tribunal composed of ourselves; and of this half, namely, sixty, a mere six are admittedly possessed of adequate clinical training in obstetrics.

A recent and brilliant graduate of one of

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Canada's leading schools informed me that his practical training as a midwife consisted in observing two normal deliveries at a distance of ten feet, and that his post-graduate course in the same subject at one of your pre-eminent schools was embodied in watching twelve such cases from a similar distance. Admirably trained was this man, but not as an obstetrician — rather as an observer. And with such an instance in our minds, there may be some truth in the boast of the surgeon that in America it is safer to have one's abdomen opened for any chronic condition than it is to bear a child. Be this as it may, it is true, I think, that brilliant surgical achievements have blinded our academic vision — our general vision — as to what is the student's greatest need in the general practice of his profession. To the average student obstetrics is perhaps the subject of greatest importance. And it were almost better, I sometimes think, if so-called classic surgery were banished altogether from our undergraduate curriculum.

In the *Journal of the American Medical Association* of January, 1912, appeared an article entitled "The Management of Normal Labor." I, for one, feel very glad that this article was written, for it has done so much to show us to ourselves. The article, you remember, professes to set forth simple rules of procedure in a case of normal labor. In all charity, it seems to me that one may surely designate its technique as careless, and characterize repeated vaginal examinations, the pushing up of the cervix over the descending head, and the delivery of a refractory placenta by even gentle traction on the cord or by grasping its lower edge, as "meddlesome midwifery." And yet these are the procedures which the article, sometimes officially, advocates. Throughout its pages internal examination and manipulation are regarded far too much as a routine and a matter of course; and this, it seems to me, is dangerous teaching.

I propose this evening to submit to you our teaching position in McGill University in respect to one or two problems of obstetrical practice. The only virtue that we can claim is that we recognize the inadequacy of our clinical teaching and are striving in every way to remedy it.

The first problem is just this one before mentioned — the management of normal labor — the oldest problem, the commonest, and the most important. I have preferred the term "the problem of spontaneous parturition" as wider and more comprehensive, since the proper conduct of a normal labor should begin long before the onset of the labor pain. A good obstetrician should be wise before the event, and not alone at the actual crisis. It is not enough that he should go when he is sent for — "when the woman expects to be in labor," to use the words of the *Journal's* article — but he should go to all his *booked* cases unsolicited, some six weeks before the time.

1. THE PROBLEM OF SPONTANEOUS PARTURITION

As I have already intimated, the proper solution of this problem demands a careful examination of the pregnant woman some four or six weeks before the date of her confinement. If this is true in all cases, it is particularly true in women gravid for the first time. To omit such an examination in primiparæ is a sin of gross carelessness, no matter how busy the practitioner or how humble the patient.

The routine examination at such a time, say at seven and a half months, is to include (*a*) a careful palpation of the abdomen, to determine the size of the child, the presenting part, and its position; (*b*) the measurement of the pelvis, notably that of its external conjugate or Baudelecque's diameter, and the transverse diameter of the outlet; 19 cm. should be graven upon the first diameter and 10 cm. upon the second, as anything short of these means trouble in delivery. At the same time, it is wise to palpate the depth and inclination of the pubic arch in selected cases, to verify the health of the vulva and urethra, and always to ascertain the condition of the nipples and breasts.

No internal examination need be made, provided that all normal conditions are satisfied. If there is any doubt, the diagonal conjugate should be measured. There are here three outstanding rules:—

1. In primiparæ, when the head presents it must at this time lie low in the pelvis, well engaged in the upper strait.

2. If the breech presents leave it alone, or, as they have it north of the Tweed, "For God's sake leave it be."

3. Do not forget the urine. Each week it is to be examined in its specific gravity, and for albumin and sugar.

And now, when labor calls, the physician goes forearmed. Sterile rubber gloves and a gown, at least fresh laundered, are not only wise, but essential; so, for the patient, is a general bath, a soapsuds enema, and a shaving of the vulva hair. The physician, by abdominal palpation, ascertains whether or no labor has begun, estimating by the sense of touch the strength of the uterine contractions; he rehearses in the same way the presentation and position of the "passenger." The location of the fœtal heart assists in this, and its rhythm indicates the vitality, if scarcely the sex, of the child.

No further examination is at this time advisable. If, however, the first stage be prolonged, the condition of the cervix and the degree of dilatation of the os may be ascertained, per rectum, by the gloved finger. This necessitates, however, a second pair of gloves.

In normal labor rupture of the membranes usually coincides with the full dilatation of the cervical canal. When this occurs a careful vaginal examination may be made; its object is to ascertain if the cord or any fœtal member be prolapsed, and to learn the position and likely mechanism of the presenting part. In primiparæ, where the presenting part has been from the first well engaged, this examination can safely be withheld. Such an examination means an entrance for the first time upon the field of operation, and it should always be fearfully undertaken, not as the fool who rushes in but as the fearful angel. The vulva and vulvar slit are cleansed with soap and water and the free use of some strong, non-irritating antiseptic, and the cleansed parts are then isolated by sterile towels, or fresh towels wrung out of a strong solution — the so-called "carbolized" or "perchloride" towel is perhaps the best.

During the second stage the patient must be kept in bed, and with the incidence of the pains chloroform or ether may be given. When the head "crowns," a choice must be made of the position for delivery. In these spontaneous cases I prefer the left lateral, as it is in this way easiest single-handed to watch and protect the perineum. A good technique may be observed, though this is not so easy as in the dorsal position. The delivery of the head is most safely effected in the interval between the pains by means of Ritgen's method, the left hand operating between the patient's legs and favoring the right extension of the head by pressing first the occiput and then the nape of the neck forward against the pubic arch. The head delivered, free the neck from any coils of cord, and guard as carefully as the passage of the head the transit of the shoulders. The left hand placed upon the uterine fundus follows it gently down in the final expulsion of the child.

The anæsthetic is now discontinued and the woman turned gently upon her back. The child is allowed to imbibe through its newly-established pulmonary circulation the maximum amount of its own placental blood before the cord is cut. The mother's hips are now brought to the edge of the bed and a registering clamp placed at the vulva upon the dependent cord, while the uterine fundus is simply outlined with the hand, and the conduct of the third stage begins. In such normal cases, this is the stage that requires the most attention, patience, and skill. Ample time should be given for the spent uterus to recover, while the fundus is simply guarded in the quiescent hand. At this time kneading of the uterus should not be employed, as this tends to prevent the formation of the central hæmatoma by which the separation of the placenta is brought about. An armistice of at least thirty minutes should, if necessary, be declared. The fundal hand notes the gradual recovery of the uterus, and as the contractions strengthen the patient will again complain of pain. Extrusion of the placenta into the lower uterine segment or vagina frequently occurs spontaneously, and is marked by the elevation of the fundus, the elongation of the

uterine axis, and by the escape, as measured by the position of the clamp, of three or four inches of the dependent cord. When this occurs, the complete expulsion of the placenta may be at once achieved by a voluntary bearing-down effort of the patient herself, or by a modified Credé, the two walls of the uterus being firmly pressed together, and the organ so compressed being pushed down as a piston into the pelvis. Separation of the placenta and its extrusion from the active portion of the uterus is a physiological prcoess and is usually spontaneous; in most cases it is only its expulsion from the lower uterine segment, or vagina, that requires assistance. While a retained placenta is common enough, an adherent placenta is comparatively rare. No traction should be exerted upon the cord, and only as a last resource is the placenta to be sought by an inserted hand.

Upon its delivery the placenta should be rotated several times in order to weave into a cord the following membranes, so as to ensure their complete removal. Kneading of the fundus may now begin, and must be persisted in till the uterine contractions are well maintained. The fundus should be steadily watched by the doctor or the nurse for at least an hour after the delivery of the secundines. The perineum and the lower third of the vagina is carefully inspected, and tears repaired by immediate sutures. In such a normal case the cervix need not be examined. It may be for the time left to care for itself.

The vulva should be carefully cleansed and covered by a sterile pad, applied with a T bandage. Ergot need not as a routine be exhibited, and the wearing of an abdominal binder may be left to the inclination of the patient.

The secundines floated in water should be always carefully inspected, especial care being taken to ascertain that the maternal surface of the placenta is intact.

Such is, very shortly, our teaching of the conduct of spontaneous parturition. The attempt is always made to instil and enforce the two ideals of cleanliness and a masterful inactivity. It is always declared that each man must master for himself the details of a practical, consistent, workaday technique, make it his very own, and always employ it — the staff and scrip of his obstetrical pilgrimage. So provided, the solution of at least 80 per cent of his obstetrical problems is assured and the verdict for three quarters of his work can be pronounced well done.

THE PROBLEM OF THE UNENGAGED HEAD AT THE END OF THE FIRST STAGE OF LABOR

By this I mean that the cervix is fully dilated, or nearly so; that the membranes are intact or only recently ruptured, while the head is not definitely engaged in the upper pelvic strait. I have chosen this problem as it is the one that frequently, and often unexpectedly, meets each one of us, and as upon its proper management so much depends. At first sight, too, it is often so simple a complication, so innocent of consequences; and yet, if wrongly managed, it so frequently leads to disablement, or even disaster.

The gravity of such a condition in different cases is as widely asunder as the poles, according as the patient be gravid for the first time or not. In primiparæ, where the child's head during the later weeks of pregnancy should lie always well engaged within the pelvis, it means in every case no little disproportion of the "passenger." In multiparæ this may or may not be so. In multiparous women, faulty positions of the head or undue obliquity of the whole fœtal axis, as in pendulous belly, may be the single, easily remedied causal factor. There is, moreover, the guiding voice of the history of previous labors, and the soft parts below are roomy and well dilated. There is no comparison between the gravity of this condition in the two groups of cases, and since, if one can treat the more serious he can assuredly negotiate the less, I shall deal chiefly with this complication in primiparæ.

I have chosen for discussion here solely those more difficult "border-line cases," if you will, where there is only moderate disproportion between the mother and the child. Such cases are more common, and more difficult to recognize and to treat, than those where the disproportion is great, the diagnosis in consequence easy, and the choice of interference arbitrary. A simple way to state this problem

is to say that here the true conjugate of the mother's pelvis is barely equal to the biparietal diameter of the head of the average child; or, to express it in figures, the true conjugate measures but 9 cm., while the biparietal diameter is 9.1 or 9.2 cm.— in a primipara, a conjugate vera of 9 cm. and an average child.

And here a word as to prophylaxis. It is once more the old story, that, had you been aforetime here, this had not happened. At least it is true that if the essential eight months' visit had been paid the condition would have been recognized with some four weeks yet to go — four weeks in which to think, to act, or to get assistance. In all primiparæ I urge again the imperative necessity of such a preliminary visit, though here and now it is too late.

The problem divides itself into two parts: (1) How to ascertain the facts, and (2) how to manage the condition. And again, the view only is taken of what we are to teach our average student.

1. *How to ascertain the facts.* The two essentials here are *method and a clean technique.* The rectum has of course been previously evacuated. Convince yourself first, with a catheter if necessary, that the urinary bladder is empty, and then of the presence and vigor of the fœtal heart. The vulva and vulvar slit are carefully sterilized and full anæsthesia is induced, for a thorough internal examination must now be made. The diagonal conjugate is first carefully measured, either with the fingers or with a pelvimeter, such as that of Gauss. Eleven centimetres, a trifle more or less, will be the reading. It matters not at all in such a minor contraction whether the type of the pelvis be a generally contracted, a justo-minor, or a flat. In both these cases the true conjugate may be left to answer for the pelvis; and this true conjugate is here 9 cm.

There now remains the estimate of the child's head. In such a case this is most readily achieved, I think by Müller's method of impression. An assistant grasps the brow and occiput of the head from above through the abdominal wall, and presses it firmly downward and slightly backward into the axis of the pelvis. When this is done the fingers in the vagina, tracing the margin of the pelvic inlet upon the head, can estimate the degree of disproportion. If single-handed, Munro Kerr's modification may be used, the thumb above the pubis measuring the degree of overlapping. Before the hand is withdrawn the actual position of the head is to be verified by complete palpation of the occiput or face, and at the last the size of the pelvic outlet. It need not be repeated that these maneuvers are carried out under a rigid surgical technique.

Corroborative evidence as to the normal size of the child may be obtained by measuring the height of the uterine fundus as 35 cm., and the occipito-frontal diameter of the head as 11.5 cm., by such a method as that of Ellice Macdonald.

The total result of our findings is that the child's head jams with but slight overlapping in the upper strait, and that for delivery we must depend upon head molding and compression.

2. *How to manage the condition.* The first injunction and the last is, *do not hurry.* While carefully watching the condition of both mother and child, leave the case alone. Statistics here are a great comfort, as they record in 80 per cent of such cases a spontaneous delivery; and, as appeared last year in Williams' "Questionnaire," the better results of the midwives in such cases was because they did not know enough to interfere.

Some help may be given by posturing the patient. The Walcher position does increase the true conjugate about 1 cm., and the patient should occupy this position at intervals as long as she can stand it. At the same time, during the pains, moderate pressure from above, downward and backward, should be made upon the head. The Scotch midwives kneel these patients before a wooden chair, resting upon the seat and the hands grasping the back above. In this attitude the uterine axis falls forward to correspond more nearly with the axis of the pelvis inlet, and engagement of the head is thereby promoted. At least it may be tried.

The first rule is, *do not hurry;* and now the second is *do not turn.* Prophylactic version in contracted pelvis is for the expert. In his

hands, within certain narrow limits, it possesses certain usefulness. But these limits are too fine, too difficult to estimate, for the average practitioner, and any miscalculation means at the very least a murdered child. A pubiotomy or a Cæsarean section are scarcely to be undertaken outside a hospital service.

And so the mother and child are carefully watched in any ordinary case for at least four hours. If after this time the head does not descend, axis traction forceps may be applied. There is here need for great care. Steady, moderate traction at intervals, with the woman if need be in the Walcher position, will soon decide the issue; it must decide the issue. No great force need be used. If the head does not advance the delivery of a living child must be abandoned, and our interests now are centered solely on the mother. With the forceps still applied, the child's head may be perforated between the blades and so delivered; or a cranio-clast may be used. To the general practitioner the fault is not so great that it has happened once; but grave fault is it if with this same woman it happen once again.

THE MALIGNANCY OF GIANT CELLED SARCOMA[1]

By J. CLARK STEWART, M. D., Minneapolis, Minnesota

WHAT is a giant cell sarcoma? Authorities answer, a sarcoma which contains a large number of giant cells. Just how many giant cells seems undetermined so long as there are enough to give a distinctive picture.

The sarcoma matrix in which the giant cells lie is the essential element in this tumor, and is responsible for its clinical features. This is usually of a spindle or mixed cell type. Are these tumors malignant? There has been a great deal of writing lately to show that they are not, and statements are freely made that they never form metastasis and possess but limited malignancy.

Both of these propositions I wish to disprove by the citation of observed cases. These tumors occur in relation to bones as either periosteal or central growths, and in either situation are of slow growth and delayed malignancy. Either form can, in my experience, cause death, and the central form has shown the more malignancy.

Case 1. A man aged 35 developed a small tumor at the base of his great toe. This grew slowly and after a time presented the symptom of pulsation to so marked a degree that the attendant diagnosed aneurism and tied the dorsalis pedis artery without relief. The disease continued to progress and a tumor developed at the middle of the tibia above. At this time the patient came into the hands of Dr. James E. Moore, with whom I saw him in consultation. Dr. Moore amputated the leg above the second tumor, and it was noticed that the external saphinous vein was plugged with sarcoma at the site of amputation, and hence below to the primary tumor. The tibial tumor was central and had caused a pathologic fracture.

This patient died after a few months with local recurrence in the stump and a metastatic tumor in the brain. The primary tumor was central in the metatarsal bone of the great toe, and had perforated the bony shell, giving rise to the symptoms of bone aneurism. It was a giant cell sarcoma containing many large giant cells in a mixed cell matrix with many marrow cells. The secondary tumor in the tibia was true to type, as was the plug in the vein. The total duration of this case was under two years.

Case 2. A cowboy, aged 30, gave a history of breaking his left arm while mounting his pony. The fracture failed to unite, and after three months he came to Minneapolis to Dr. W. E. Rochford, with whom I saw him in consultation. The arm at this time was greatly swollen from elbow to shoulder, and crepitation was evident. I made a tentative diagnosis of sarcoma, which was confirmed by an exploratory incision. The arm was amputated at the shoulder, removing all suspicious tissues. Recurrence was prompt and death occurred within six months.

The arm showed a central giant cell sarcoma which had destroyed the bone from four inches below the shoulder to within two inches of the elbow. The muscular tissue was deeply infiltrated by the tumor. The microscope showed a typical giant celled sarcoma, with spindle cell matrix.

[1] Read before the Minnesota Academy of Medicine, April 2, 1913.

These patients died of sarcoma of the giant celled type, both originating in the medullary cavity of a long bone, so it must be admitted that giant celled sarcomas do cause death. The first case developed metastasis, which must also be admitted.

I am of the impression that these central tumors are fairly benign so long as they do not perforate the bone, but that after perforation they become malignant and cause death as other sarcomas do.

It is easy to see how the idea of benignancy has arisen in these cases. The X-ray has made diagnosis easy and early, and has allowed them to be thoroughly removed locally before marked malignancy has developed. Few cases are neglected at this day, and it is natural that local nonrecurrence should spell benignancy. The same conclusion could as justly arise in the mind of a present day student in regard to ordinary cyst-adenoma of the ovary. He sees the diagnosis made and the cysts removed with nonrecurrence, and his conclusion would be that such cysts were absolutely harmless, instead of being regularly fatal when allowed to take their natural course.

The giant celled periosteal sarcoma of the gums, epulis, makes the nearest approach to benignancy of any tumor histologically diagnosed sarcoma, but even here occasionally there are cases that take on malignancy as shown by repeated recurrence and extensive growth.

I was much interested in an article in the February number of the Annals of Surgery by Dr. George Barrie on chronic hæmorrhagic osteomyelitis (synonym, giant cell medullary sarcoma). From the description given of the cases it does not seem to me that the diagnosis of central giant celled sarcoma was justified, but rather that of nonsuppurative osteomyelitis, as the description of the gross and microscopic findings tally exactly with those of the cases I described as nonsuppurative osteomyelitis before the Western Surgical Society in December, 1910. Here again comes the question whether giant cell sarcoma can be diagnosed without the presence of sarcoma. Certainly the results of microscopic examination reported by Dr. Barrie would not permit of a diagnosis of sarcoma. He states that a few giant cells were found by search of a large number of slides. Certainly not the microscopic picture of a giant cell sarcoma where many giant cells can be found in most fields. A loose fibrous structure infiltrated with small round and epithelioid cells certainly can not be diagnosed sarcoma, but is distinctly the picture of a chronic inflammatory process.

The other cases described furnish no microscopic findings, the diagnosis being made entirely on clinical, and even, in one case, on skiagraphic findings. Certainly a unique way of diagnosing a specific variety of sarcoma.

It is, I think, unfortunate to use the term sarcoma unless you mean sarcoma, and it must always be remembered that a giant celled sarcoma is only a sarcoma containing giant cells and its malignancy depends upon the character of the sarcoma matrix. The most usual type of matrix is spindle celled, hence these tumors are slow-growing and less malignant than many other types of sarcoma.

The cases cited in this paper, while few in number, certainly prove malignancy, and one fatal case is enough to disprove all theories of nonmalignancy.

OBSERVATIONS ON THE ABBOTT TREATMENT OF ROTARY LATERAL CURVATURE OF THE SPINE AND DETAILS OF THE TECHNIQUE

By SAMUEL KLEINBERG, M. D., New York City

THE Abbott method of treating rotary lateral curvature of the spine depends on the theory that the spine is bent laterally and is rotated easiest when relaxed. It has been proven on the cadaver and in the living being that the vertebræ and more especially the dorsal vertebræ, bend laterally and rotate freely in the flexed position but are locked and immobilized in the erect or hyperextended posture. The Abbott method is a treatment in flexion. Pressure solely over the region of the deformity, particularly when the upper and lower portions of the trunk have been fixed, pushes the spine forward, and extends and hence locks the vertebræ against any corrective influence. This, the main principle of former methods of correction, accounts for so little progress in the past in the treatment of fixed lateral curvature of the spine.

Hence, in the Abbott method not only must we during the application of the plaster jacket attain flexion, but it is equally important in the subsequent treatment to pad or pack the jacket only in such way as to maintain, and possibly increase, the flexion. There appears, however, to be a limit to the amount of flexion the patient is to be placed in, for the body in extreme flexion does not lend itself to much side-bending or rotation.

Flexion and relaxation of the body are obtained in this method by placing the patient in a hammock made of canvas or muslin, suspended in a rectangular gas-pipe frame.

Beneath this there is another frame of similar dimensions, and to the bars of both frames are attached the fixing or corrective bands to be spoken of later.

The preparation of the patient plays an important rôle in the treatment. Felt one half to three quarters of an inch thick is used, this being a more certain protection to the skin than cotton or flannel. One or two thicknesses of felt are placed over the projecting ribs and convexity of the thorax, reaching laterally from the spine to the anterior axillary line, and in girls over the mammary region. This pad should fit well around the chest and be secured between two undervests. A removable pad of two or three layers of felt should be placed over the concavity of the posterior surface of the chest; this pad should cover only the hollow part of the chest, and in cases of compensatory lumbar curves should not extend over the prominent lumbar region. At either lateral extremity this pad should be somewhat thicker than in the middle, so that near the spine, when the pad is removed, the cast will be one or two inches distant from the body, sloping gradually away from the most prominent part of the deformity, while in front the cast, instead of being rounded and hugging the chest well, will at the anterior axillary line stand away from the ribs. Another removable pad of one or more thicknesses should be placed over the ribs in front of the chest on the side of the deformity; when this pad is taken out it allows for expansion of the chest and ribs on that side. These removable pads are placed between the second and third undervests, and are taken out as soon as the jacket is completed. In all, the patient has three shirts under the plaster. Protective pads are placed over the crests of the iliac bones and over the sacrum, although the latter in my experience has not seemed essential.

The patient thus prepared and placed in the hammock, the extremities of the trunk are flexed by means of bandages of unyielding material, like canvas, four to five inches wide. The thigh on the side of the deformity is fixed by a bandage that pulls directly backward. The pelvis is then fixed by a bandage which, attached to the frame on the deformed side, passes under the body, over the hip on the concave side, in front of the

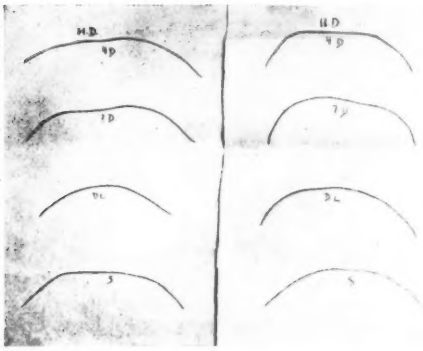

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Fig. 1

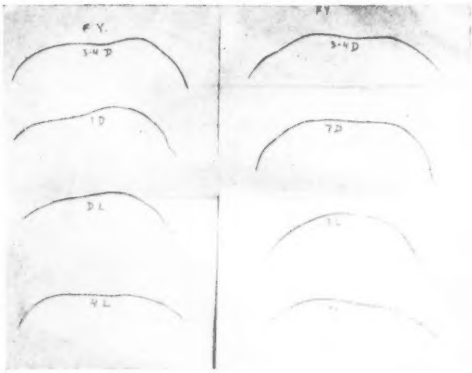

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Fig. 2

pelvis and is directed backward over the hip of the deformed side. It is advantageous to have this bandage adjusted to pull slightly downwards against the upward pull of the band fixing the shoulder girdle. The latter bandage is next applied; this, tied to the frame on the deformed side, passes under the neck, over the arm of the concave side, and in front of the neck. Before this bandage is secured the legs are raised to an angle of 60 or 75 degrees, to increase the flexion of the body; the chest is twisted so that the deformed side is brought forward and the hollow side backward, the high shoulder is lowered, and the low shoulder elevated as far as the patient will permit. Another bandage now embraces the low shoulder and pulls it forward. Two correction straps are now attached to the side of the frame next to the concave side of the chest, and pass in back of the chest, over the deformity, onto the front of the chest; one of these bandages is then utilized to pull directly sidewise and obtain as much lateral correction as possible, while the other is directed backward over the prominent ribs, tending to correct the rotation of the ribs and corresponding vertebræ. These are the most important bands, as they correct the lateral bend and rotation. We thus have the patient flexed and bent and twisted in the direction opposite to that of the deformity.

Plaster bandages are then applied with reinforcing pads over the convexity, around the pelvic and shoulder girdles, and in front opposite the hollow. Fenestra are next cut out, one very large window over the concavity of the chest behind. This must extend forward to or even slightly beyond the anterior axillary line, so that the front pads will push the chest directly backwards and not laterally to the side of the deformity. An oblong-shaped window is cut out over the region of the sternum, through which the anterior pads are inserted. Another window is cut out of the plaster in the back, a little to the outer side of the most prominent part of the deformity, and the fourth and last window is cut in the axillary region of the same side. The last two windows must be so placed that felt pads going through them will tend to push the chest forward and to the opposite side. In trimming the jacket the lower border must be made exceptionally low in the back and about an inch above the pubic symphisis in front. Above, the low shoulder must be allowed to fall forward by cutting the plaster very low in front and high in the back; exactly the opposite must be obtained for the high shoulder. We must have a jacket that is very much longer on the concave side than on that of the deformity. During the application of the jacket the patients all complain of tightness across the chest and difficulty in breathing; this is immediately

Fig. 3. a.

relieved when the removable pads are taken out.

Padding is begun several days after the application of the jacket, and is repeated as often as the patient can stand it. We now come to a very important and often, to the patient, the severest part of the treatment. If the jacket has been accurately applied each pad causes discomfort and pain, and as the pads increase in number the discomfort increases. At times pain after padding is only temporary, lasting from a few hours to a day or two, but often it continues until either one or two pads are removed; or if too many pads have been inserted, and the chest has come close against the jacket, the latter has to give way to a new one. Most of the pain is on the side of the deformity and over the sternum. The elevation of the low shoulder almost invariably induces pain, especially in the neck, and numbness in the arm. Very often there results a marked subluxation of the acromioclavicular joint of the low shoulder that does not readily reduce itself when the jacket is removed. From six to twelve pieces of felt can be placed in front and half as many on the side before the jacket must be changed. The time spent in accomplishing this amount of packing varies from a few weeks to two months, depending upon the rigidity of the spine and the tolerance of the patient. Almost all patients, and especially after several pieces of felt have been inserted, suffer from insomnia. It is often very difficult for them to find a comfortable position; many, perhaps most of them, feel best in a hammock, while others relieve their discomfort by leaning forward on some object. Shortness of breath and pain interfere most with packing. In two instances, vomiting followed the application of the jacket for one or two days, while frequently loss of appetite persists for many days. In two cases, the removal of the patient from the frame was followed by an extreme pallor and marked prostration that persisted for several hours. One of the commonest sequelæ is a disinclination to physical

Fig. 3. b.

Fig. 4. a.

Fig. 4. b.

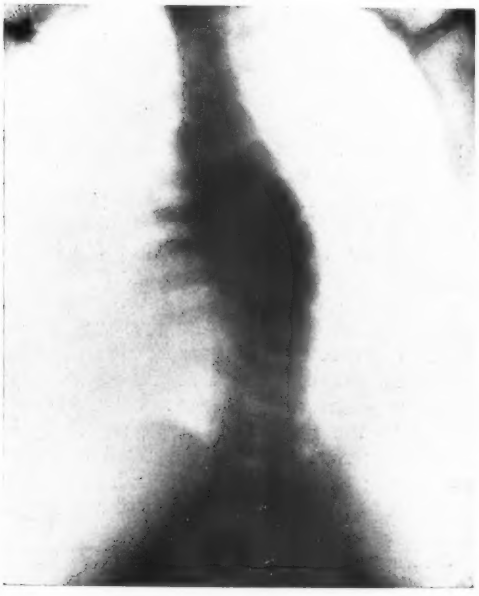

Fig. 5. a.

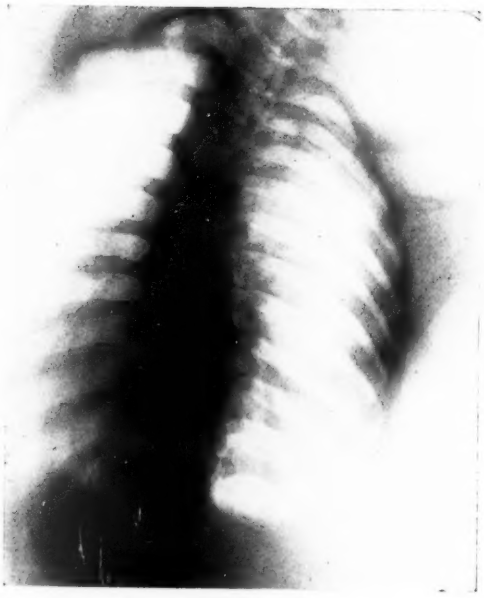

Fig. 5. b.

Fig. 6. a.

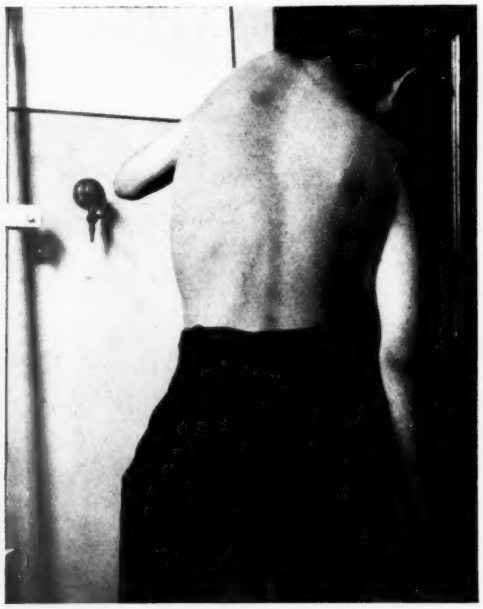

Fig. 6. b.

exertion of any kind, a tiredness and weakness which in one case did not permit the patient to stand up or walk more than two or three minutes at a time. In most cases the pulse rate was accelerated; in a series of 10 cases reviewed in one afternoon, in 6 the pulse ranged between 110 and 132, in 3 others between 84 and 96, while in one the pulse was 80 per minute before the application of the jacket and 120 after the plaster was put on, and continued at that rate until the jacket was removed.

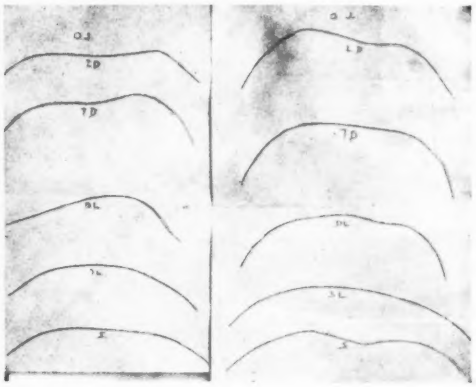

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Fig. 7.

In many cases the anteroposterior diameter of the chest on the concave side is markedly reduced; in three or four of my cases this was so severe that the chest wall was no more than two and a half to three inches thick. Due to this diminution in the size of the chest, the cardiac apex was palpable, and in a few instances visible on the posterior surface of the chest. Nor is this compression of the concave side of the chest always accompanied by a corresponding reduction of the deformity. A very distressing though not dangerous sequel to the front padding is, especially in thin subjects, a pronounced incurvation of the chest; this, however, does not persist for more than a few days after the pressure is relieved.

In all the cases treated it has been possible in the frame to produce side-bending and rotation of the chest, and the subsequent

Fig. 8. a.

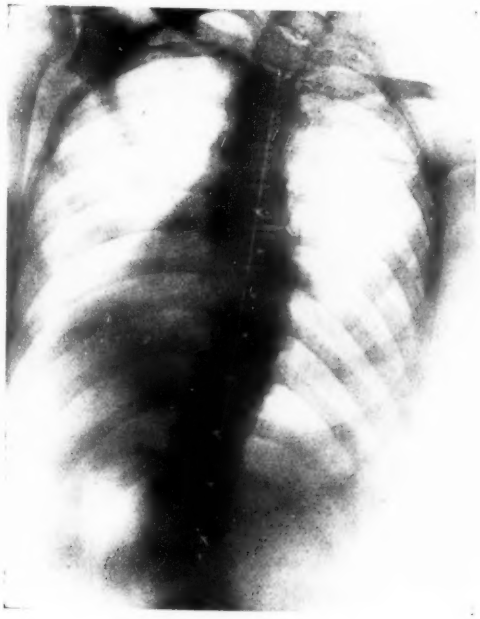


Fig. 8. b.

Fig. 9. a.

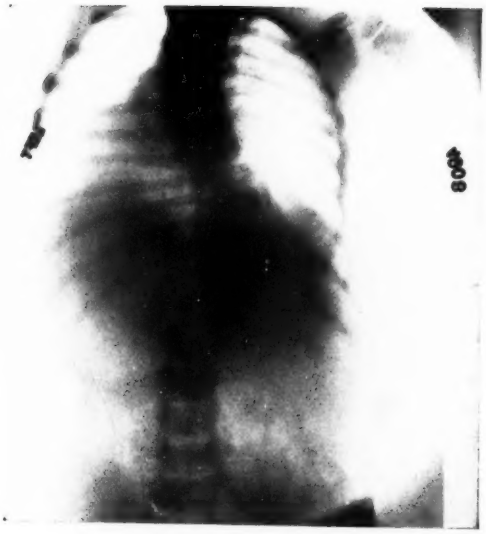
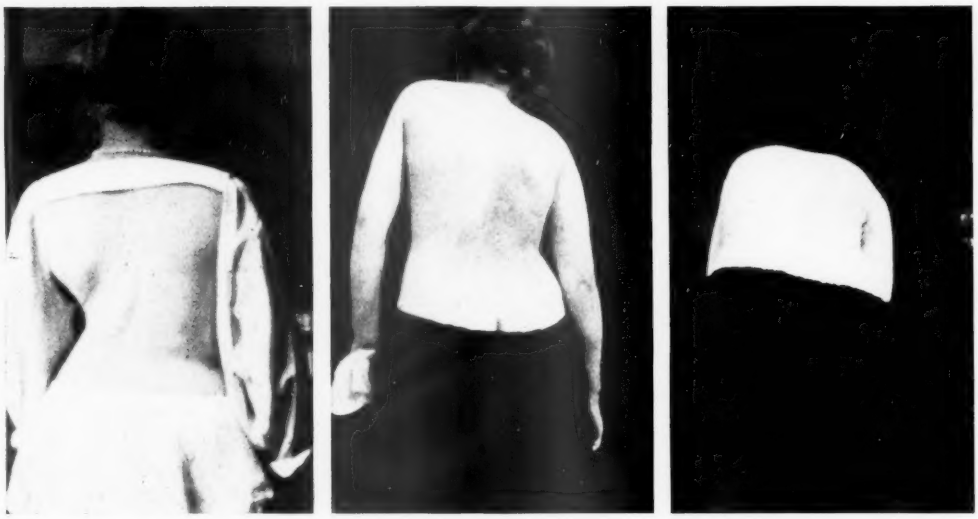


Fig. 9. b.



a b c

Fig. 10.

packing has increased this and in most cases diminished the deformity, but in the majority of cases, the moment the cast is cut and the patient stands up the deformity relapses. The amount of relapse depends on the correction obtained in the jacket; the more the chest is stretched and the spine pushed laterally, the less will the spine relapse. An X-ray picture taken of a spine in a jacket will show much less deformity than an X-ray of the same spine outside of the jacket. This relapse, however, takes place, I believe, only so long as the spine is not entirely overcorrected. In the overcorrected cases the spine goes back very little outside of the jacket. The problem resolves itself into one of complete and thorough overcorrection before the jackets are removed.

It has been remarked that, due to greater expansion of the lungs in the upper part of the chest, the high cervico-dorsal deformities should respond very rapidly to this method of treatment. In three cases in which I persisted for four or five months, I obtained absolutely no improvement. Nor do I see how, with the present form of the jacket, it is possible to influence a deformity that involves the lower half of the neck, for raising the low shoulder so high that the clavicle is brought up against and parallel with the neck has not made any perceptible difference; possibly if these jackets are made on the style of Calot jackets, corrective pressure may be of some service.

In all, 31 cases have been treated since January of this year. Of these, 10 gave up the treatment after one or more months, due mostly to the inconvenience and pain experienced. In most of these, however, improvement had been observed. Three cases were abandoned because no improvement was obtained after several months' treatment; 18 are under observation and are seen two to four times a week. All cases treated were ambulatory, and none were given morphine. In two or three instances, moderate doses of codeine were given for the pain and discomfort; the relief was slight and did not warrant the continuance of the drug in the doses administered, and hence was given up.

Of those cases under observation, one, a girl of seventeen with a severe right dorsal and left lumbar curve, under treatment for nine months, during which time she has had seven jackets, has not made any perceptible progress. Thirteen cases have improved,

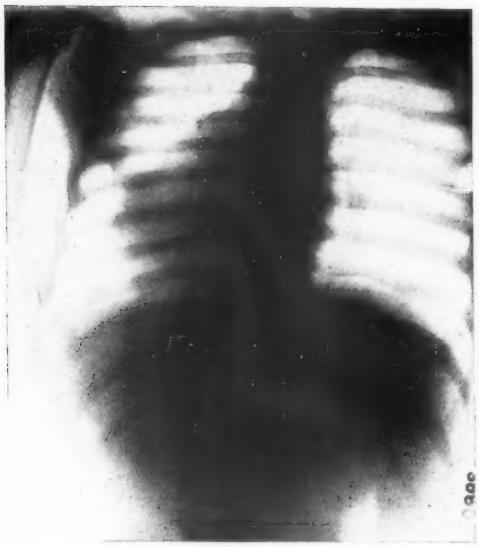


Fig. 11, a.

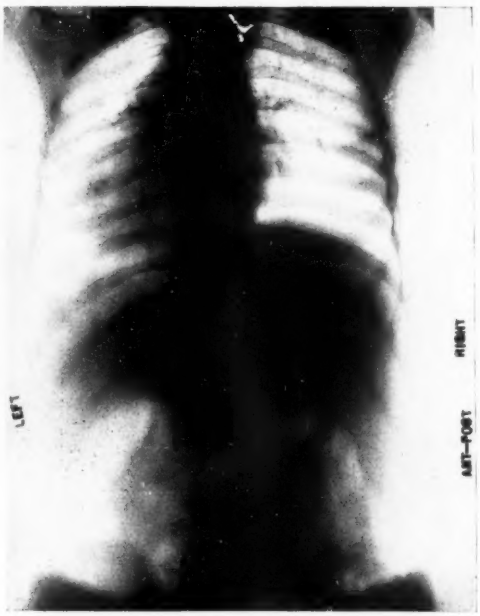


Fig. 11, b.

some very markedly, and in two or three instances almost corrected. Four cases have been overcorrected.

Of those cases that gave up treatment, one girl thirteen years old, with a moderate left dorsal and right lumbar curve, was corrected though not overcorrected at the time she discontinued the treatment; when seen eight weeks later, having worn during this period a very ill-fitting jacket and not taken any exercises, her deformity had completely recurred. Another girl of fifteen, whose deformity was readily overcorrected in the jacket, could not retain any of the correction when the plaster was removed; she, however, was under treatment only two months.

The following is a review of some of the cases treated:

H. D. (Fig. 1), a boy 9 years old; right dorsal curve of moderate severity. On March 21, 1912, a corrective jacket was applied; this was kept on until July 11, 1912, with very little packing; when removed, the deformity was found to be reduced. Another jacket applied, felt pads now, and when removed on August 27, 1912, the spine was observed to be in an overcorrected position. Compare Fig. 1 containing tracings of the plaster mold of patient's back taken March 21, and Fig. 1, *b*, which shows tracings of a mold of the same back taken August 27, 1912. The difference is especially evident on the seventh dorsal level (7, *d*) and the dorso-lumbar region (DL).

F. Y. (Fig. 2), a girl 7 years old; right dorsal and left lumbar curves of moderate severity. Treatment begun January 16, 1912, and discontinued May 23, 1912; several jackets applied during this time. Tracings taken before and after treatment (Fig. 2, *a* and *b*) show the correction; this is also shown by the photograph of the girl's back (Fig. 3, *a* and *b*). From May until the time of the writing of this paper this patient has gone without any mechanical support, but has retained her correction.

M. N. (Fig. 4), a boy 16 years old; right dorsal curve as shown by X-ray taken May 1, 1912, in Fig. 4, *a*. Four corrective jackets applied, and on September 10, 1912, as shown in X-ray (Fig. 4, *b*), the spine is overcorrected. This boy's deformity was of a mild degree.

J. B. (Fig. 5), a boy 15 years old; right dorsal left lumbar curves as shown in X-ray (Fig. 5, *a*) taken August 16, 1912. Several jackets were applied, and on October 11, 1912, as shown in X-ray (Fig. 5, *b*) and in photo (Fig. 6, *a* and *b*) taken September 14, 1912, the patient's spine is overcorrected.

O. J. (Fig. 7), a girl, 15 years old; severe right dorsal and left lumbar curves. This patient has had nine corrective jackets during a period of nine

Fig. 12.

months. As shown by tracings of casts of her back (Fig. 7, *a* and *b*), she has been greatly improved. X-rays of this spine do not agree with the external appearance of the patient's back, as they show no improvement. Moreover, the patient is unable to retain outside of the jacket the corrected position in the plaster jacket.

I. B. (Fig. 8), a girl 13 years old; right dorsal and left lumbar curves of moderate severity. This patient began treatment June 1, 1912, and had several jackets applied between this date and October 2, 1912. As the X-rays show (Fig. 8, *a* and *b*), there is a very marked improvement. This was the only patient of those not overcorrected who, during a period of three weeks, in which her treatment was interrupted, did not lose any of the correction she had been given in the jacket. During this time, however, she exercised enthusiastically.

J. M. (Fig. 9), a boy 3 years old; severe right dorsal and left lumbar curves; child rachitic. This patient is under treatment since April 4, 1912, and shows improvement as seen in X-rays (Fig. 9, *a* and *b*).

K. E. (Fig. 10), a girl 19 years old; severe right dorsal and left lumbar curves as shown in Fig. 10, *a*. This patient is under treatment about 7 months. Pictures taken in September (Fig. 10, *b* and *c*) show marked improvement. X-rays of this patient before and during treatment show very slight improvement and do not agree with the changes in the contour of the back shown by the photos.

P. B. (Fig. 11), a boy 7 years old. Right dorsal and left lumbar curves. This patient was treated from March 19 to June 27, 1912, and showed improvement as seen in his X-rays (Fig. 11, *a* and *b*).

S. H. (Fig. 12). This picture is a girl of 9 years of age, who has been under treatment several months and is greatly improved. Note the marked incurvation of her chest. Incidentally it might be mentioned that in this case it was easy to correct the rotation of the ribs and vertebræ, but the lateral deviation of the spine has not yet been reduced.

J. G., a child 3 years old; rachitic; severe left dorsal and right lumbar curves. The deformity in this case was overcorrected in about three months. The mother then took the child home and, against my advice, removed the jacket. When this patient was brought back several weeks later the deformity had completely recurred.

In conclusion, I should say that Abbott's method of treating rotary lateral curvature of the spine is a severe one, requiring much patience on the part of both the subject and the physician. Many cases can be corrected, especially the milder ones, by this method; but it corrects very slowly in most instances, and hence the treatment must be a prolonged one.

Of the 31 cases here reported, 4 were private patients, 5 from Dr. Nathan's clinic at Mount Sinai Hospital, and the rest from Dr. Whitman's clinic at the Hospital for Ruptured and Crippled. For the privilege of using their material, I desire here to express my thanks to Dr. Nathan, and especially to Dr. Whitman for his liberal advice and encouragement.

BENIGN AND MALIGNANT OVARIAN CYSTS[1]

A Report of 1000 Specimens

By WILLIAM CARPENTER MacCARTY, M. D., and WALTER E. SISTRUNK, M. D., Laboratory of Surgical Pathology, Mayo Clinic, Rochester, Minnesota

AN examination of the literature on the subject of ovarian tumors, especially ovarian cysts, shows that over 1,000 articles have been published since 1903. In the light of our present general knowledge of the subject, a review of such a wealth of recorded observations would be only of historical interest.

Most surgeons and physicians have a good working knowledge of large cystadenomata, and simple cysts, dermoids, the so-called "corpus luteum cysts" (hæmorrhagic cysts), and parovarian cysts. These comprise the cysts which are technically most easily diagnosticated and removed. The differential diagnosis of small ovarian cysts is, however, very difficult but from a technical standpoint the differential diagnosis of these has been of no immediate importance to the surgeon.

Cysts smaller than a hen's egg possess qualities which have a wide and very different prognostic significance. The main object of this paper is to call attention to the possibilities which may arise from these qualities and to present a synopsis of our findings in a study of a large number of ovarian cysts.

The material used for this investigation consisted of ovaries which had been removed for definite pathologic conditions, and apparently normal ovaries which had been removed during the course of complete hysterectomies for uterine carcinomata. Ovaries removed at autopsy were also used for comparison.

For the last six years one of us (MacCarty) has had charge of this surgical laboratory, in which, during this time, a record of one thousand ovarian specimens has been made. During this period both classification and nomenclature have changed.

The material which was examined consisted of 1,000[2] specimens, from February 3, 1905 to August 1, 1912. The various tumors occurred in the following frequency:

1.	Hæmorrhagic cysts	214
2.	Non-hæmorrhagic cysts	451
3.	Papillary and carcinomatous cysts	163
4.	Dermoids	98
5.	Parovarian cysts	74
		1,000

The duplicity of ovarian cystadenomata and dermoids can only be approximately determined from surgical material. The surgeon often leaves a small ovary without knowledge of its exact nature or through conservatism. We have records of dermoids occurring in both ovaries 14 times (14+ per cent) in 98 cases, and carcinoma occurring 7 times (7 per cent) in 97 cases.

For special examination and description, a report, of which this is the first paper, of 100 specimens were taken as representative of the 1,000, which had been recorded. These represent all the conditions which were seen in this material. Each specimen was photographed grossly, either in its fresh condition or in a fixed condition. Gross sections were made through the whole tumor and gross photographs were made of these sections. Blocks were then taken, embedded in celloidin, cut, and stained with hæmotoxylin and eosin.

With our present knowledge of physiologic and pathologic processes and their cognizable signs and symptoms, it is impossible to express diagnostic, macroscopic, microscopic, and prognostic characteristics in a diagnostic term. For this reason a method of reporting ovarian cysts similar to that used in reporting our goiter specimens[3] seems most applicable, and will be used in this paper. By the use of such a method of describing specimens of goiters, valuable assistance was rendered the clinician, and he has been stimulated to cor-

[2] This number does not represent the complete material, but is sufficiently large for a study of the conditions which one finds. Solid tumors were not considered in this investigation.

[3] N. Y. State J., October., 1912.

[1] Read before the Canadian Medical Association, August, 1912.

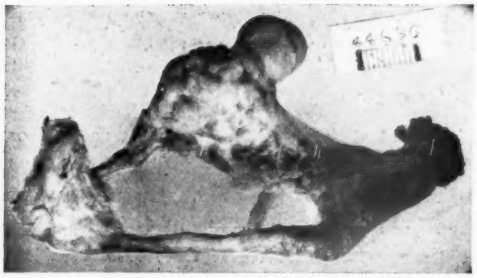


Fig. 1. A pedunculated corpus luteum.

relate clinical signs and pathologic findings more accurately.

The principal distinguishing feature in ovarian cysts is the lining epithelium. This is apparently differentiated or specialized and is most important.

Three different linings are seen, viz.: *round or oval many-layered epithelium* (Fig. 21, *a* and *b*), *columnar epithelium*, high or low (Fig. 21, *d*), and *lutein cells* (Fig. 2). These three types of cells have apparently three different functions. Whether or not the columnar epithelium and the many-layered epithelium may develop from each other is unknown. The only indication that this may be possible is the presence of both types in the same cyst (Fig. 10). Upon these fundamentals all neoplastic cysts of the ovary may be classified and described.

SIMPLE CYSTS

The simplest cyst (Figs. 3 and 4), which one finds possesses a wall, the inner surface of

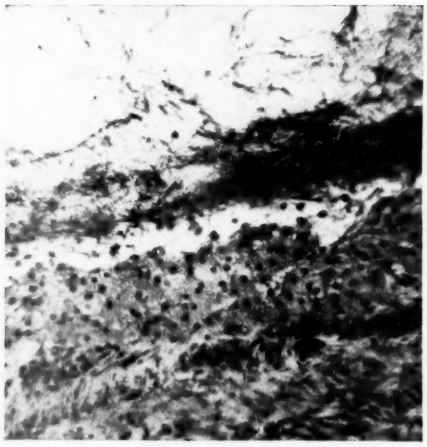


Fig. 2. Photomicrograph of a section through the wall of a corpus luteum, showing large lutein cells.

which is smooth and is composed of from two to six layers of small oval or round epithelial cells (Fig. 5). The content of such a cyst is a clear fluid.

When a Graafian follicle ceases to be a follicle and becomes a simple cyst of this description is not known. That such cysts originate from Graafian follicles is to be strongly suspected, because they have a similar lining and contain apparently the same

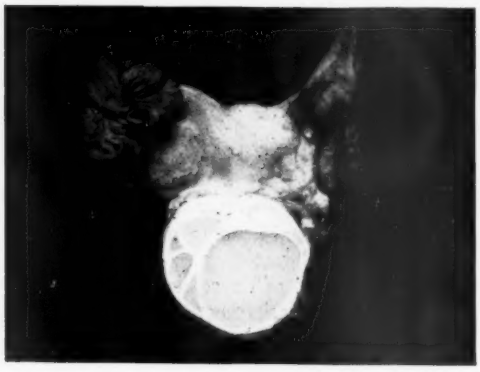


Fig. 3. Multiple simple ovarian cysts.

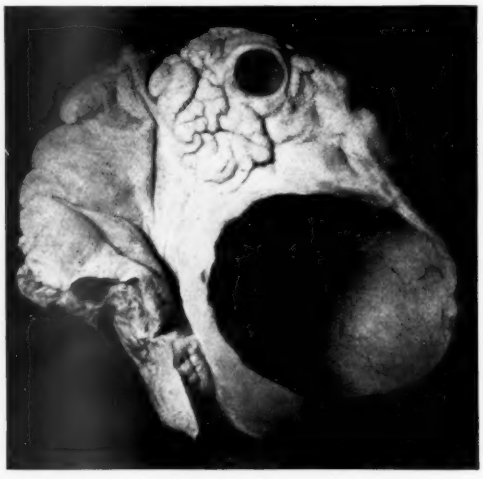


Fig. 4. Large and small simple ovarian cysts.

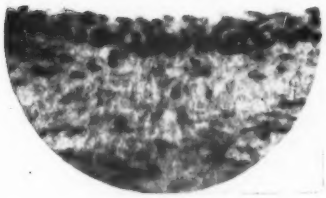


Fig. 5. Photomicrograph of the wall of a simple ovarian cyst.

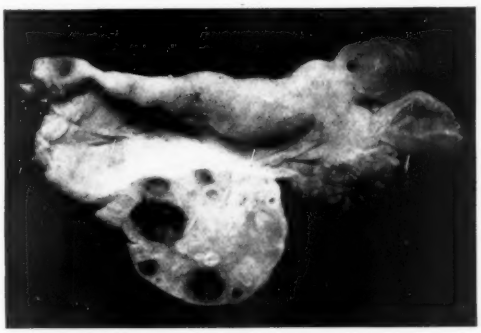


Fig. 6. Simple ovarian cysts with hæmorrhagic walls.

clear fluid. Such a cyst may attain the size of a human head. Their simplicity of structure and contents may allow the utilization of the term "simple cyst," in contradistinction to the apparently more highly differentiated cyst which is lined by columnar epithelium (Fig. 21, *c*), and which secretes a complex, highly albuminous fluid.

The secondary descriptive features of simple cysts consist in their being unilocular or multilocular, and whether or not hæmorrhage has occurred into the wall or into the interior (Figs. 6, 7, 12, and 13). They may be briefly described in pathologic reports as follows:

Simple { unilocular / or / multilocular } cysts; or,

Simple { unilocular / or / multilocular } { intracystic hæmorrhagic / or / extracystic hæmorrhagic } cysts.

Fig. 7. Simple ovarian cysts with hæmorrhagic walls.

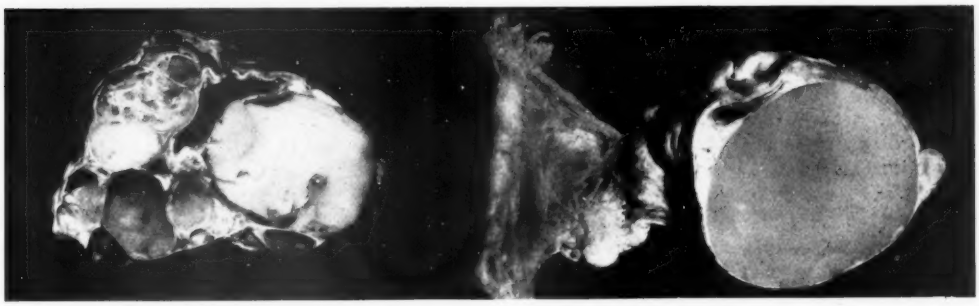


Fig. 8. Ovarian cystadenoma, showing "pseudo-mucinous" contents.

Fig. 9. Ovarian cystadenoma from the same case, but from the opposite ovary.

a *b* *c*

Fig. 10. Photomicrographs of the lining epithelium of one small cyst.

CYSTADENOMATA

This group contains all of those cysts which are lined by columnar (Figs. 8, 9, 10, 11, 15, 16, 17, 18, 19, and 20) or cuboidal epithelium and which contain a highly albuminous, pseudomucinous or gelatinous material. Cysts with these characteristics may be described as simple cystadenomata. They may be single or multiple. They may present hæmorrhage into the cavity of the cyst (Fig. 11), or into the wall. The epithelial lining may be hyperplastic and thrown into folds or papillomata (Figs. 15, 16, 17, and 19), which have connective tissue pedicles and are covered with epithelium, which is continuous with that which lines the cyst. Such papillomatous neoplasms may be intracystic (Figs. 15, 16, and 17) or extracystic (Fig. 18). The extracystic papillomata are the result of destruction of the wall of the cyst and growth into the abdominal cavity (Fig. 18). The epithelium of ovarian cyst adenomata, like that of the breast, does not always produce intracystic papillomata. On the contrary it may grow into the underlying tissue and present itself as a true adenocarcinoma, thus forming a solid mass in the walls of cysts (Fig. 20). The essential characteristics may be presented in the following descriptive terms:

Unilocular or multilocular	simple or intra- or extracystic hæmorrhagic	intracystic or extracystic papillomatous or carcinomatous.	cystadenoma.

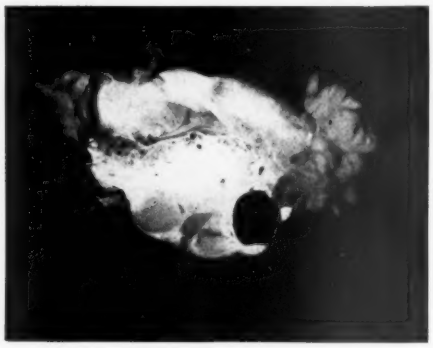


Fig. 11. Small hæmorrhagic ovarian cystadenoma.

HÆMORRHAGIC CYSTS

The line of demarcation between a normal corpus luteum (Figs. 1 and 2) and a so-called corpus luteum cyst is just as indefinite as that between a Graafian follicle and a simple cyst. In practice both the surgeon and the pathologist are prone to call any hæmorrhagic cyst smaller than the fist, or perhaps a child's head, a corpus luteum cyst. The limits of size of a corpus luteum are unknown.

In view of the fact that our knowledge on the subject is indefinite, it seems to the writers that such a definite term as "corpus luteum cyst" is not a legitimate one. It allows the surgeon to unconsciously confuse those who accept his operative reports. The diagnosis is one for the microscope, and should only be made after lutein cells have been demonstrated in the border.

Fig. 12. Large hæmorrhagic cysts ("tarry cysts"). Epithelium not demonstrable.

Fig. 13. Large degenerating cyst. Epithelial lining is destroyed; origin is therefore unknown.

Hæmorrhagic cysts of the ovary have different characteristics. They may be hæmorrhagic simple cysts (Figs. 6 and 7), hæmorrhagic cystadenomata (Fig. 11), or large corpora lutea (Fig. 13). The differentiation between these grossly has been impossible in the writers' experience.

The clinical significance of all ovarian cysts, i. e., the simple cysts, the simple papillary and carcinomatous cystadenomata, and the hæmorrhagic cysts, depends upon the life history of their lining epithelium. Ordinarily the Graafian follicle should run its natural course, discharge its ovum, and recede with the formation of a corpus luteum. In case the Graafian follicle continues to develop instead of rupturing and forming a corpus luteum, a so-called simple cyst occurs with the characteristics described above.

Experience demonstrates that malignant ovarian cysts do not possess epithelium of the type which one finds to be the dominating type in simple cysts. Their morphologic sign of malignancy is the irregular hyperplasia of the columnar epithelium of the cystadenomata. In the writers' experience, all carcinoma-

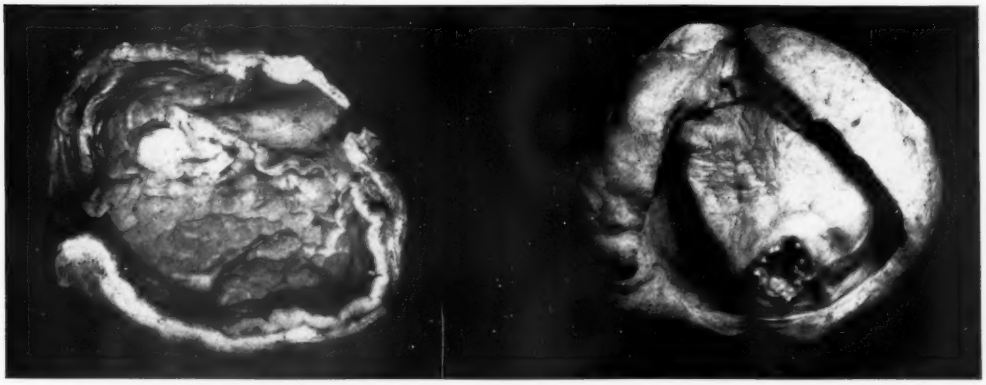


Fig. 14. Interior of an ovarian abscess.

Fig. 15. Intracystic papillary ovarian cystadenoma.

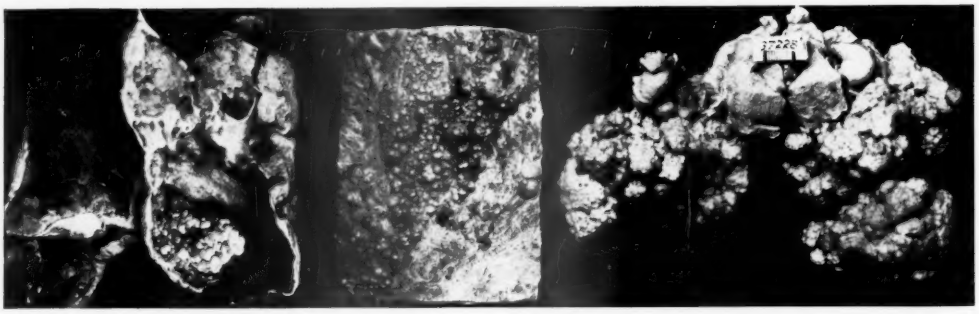


Fig. 16. Fig. 17. Fig. 18.

Fig. 16. Intracystic papillary ovarian cystadenoma.
Fig. 17. The inner surface of an intracystic papillary ovarian cystadenoma.
Fig. 18. Extracystic papillary ovarian cystadenoma.

tous and papillomatous cysts have apparently originated from cystadenomata.

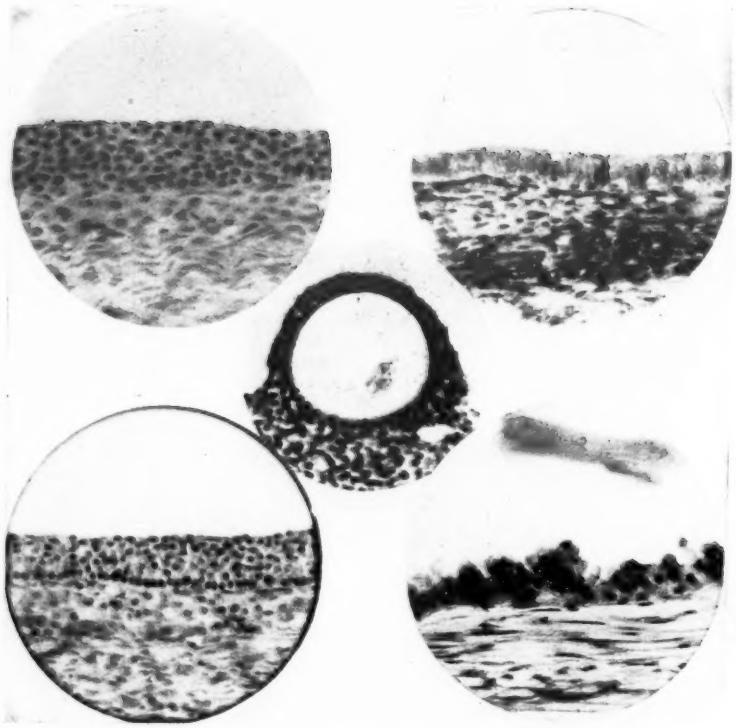
The question of the origin of the cystadenomata has been answered in literature by hypotheses rather than proof. Pflüger's tubules, Wolffian tubules or rests, and Graafian follicles have all been held theoretically responsible. In the experience of the writers, there is only one fact which points toward, at least, one source of the cystadenomata.

Cystadenomata in the ovary bear a certain resemblance to cystadenomata in the breast. This is especially true in the light of hyperplasia of the lining epithelium. In the case of the normal hyperplastic mammary epithelium one finds two distinct layers, the inner layer of which is absent in cystadenomata and carcinomata.[1] In ovarian cystadenomata and carcinomata the same phenomenon is true. During extensive hyperplasia the inner row disappears. The evidence, which points to the occurrence of the same process in the ovary may be seen in the accompanying photographs (Figs. 21 and 22). The first picture (Fig. 21, *a*) presents the lining wall of a Graafian follicle, the second (Fig. 21, *b*) that of simple cysts. In the second (Fig. 21, *b*) the epithelium is similar to that of the Graafian follicle. In the third (Fig. 21, *c*) two types of epithelium are readily visible. The inner row (the row next to the lumen) con-

[1] MacCarty Tr. South. Surg. & Gynec. Ass., 1910. Old dominion M. J., April, 1911.

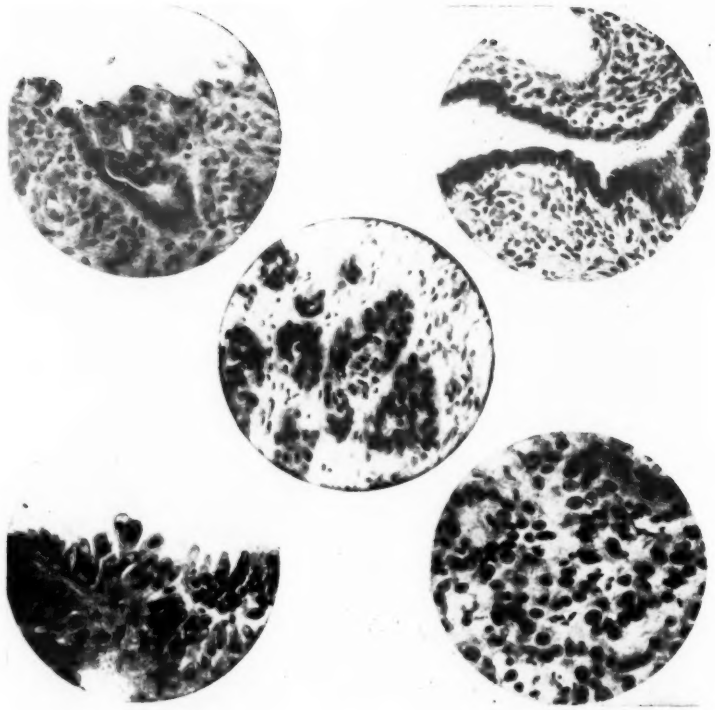
Fig. 19. Low power photomicrograph through the wall of a papillary ovarian cystadenoma.

Fig. 20. Carcinomatous ovarian cystadenoma.



b c a d e

Fig. 21. (*a*) An ovum showing the morphologic character of the lining epithelium of a Graafian follicle; (*b*) Epithelium lining a Graafian follicle or small simple cyst; (*c*) Epithelium lining a simple cyst, showing also the basal layer of cuboidal or columnar cells; (*d*) Columnar epithelium lining a cystadenoma; (*e*) Hyperplastic columnar epithelium lining a cystadenoma.



a b d c e

Fig. 22. (*a*) Epithelial invasion of the stroma in a carcinomatous cystadenoma; (*b*) Epithelial invasion of the stroma in a carcinomatous cystadenoma; (*c, d, e*) Irregular epithelial hyperplasia in a carcinomatous ovarian cyst-adenoma.

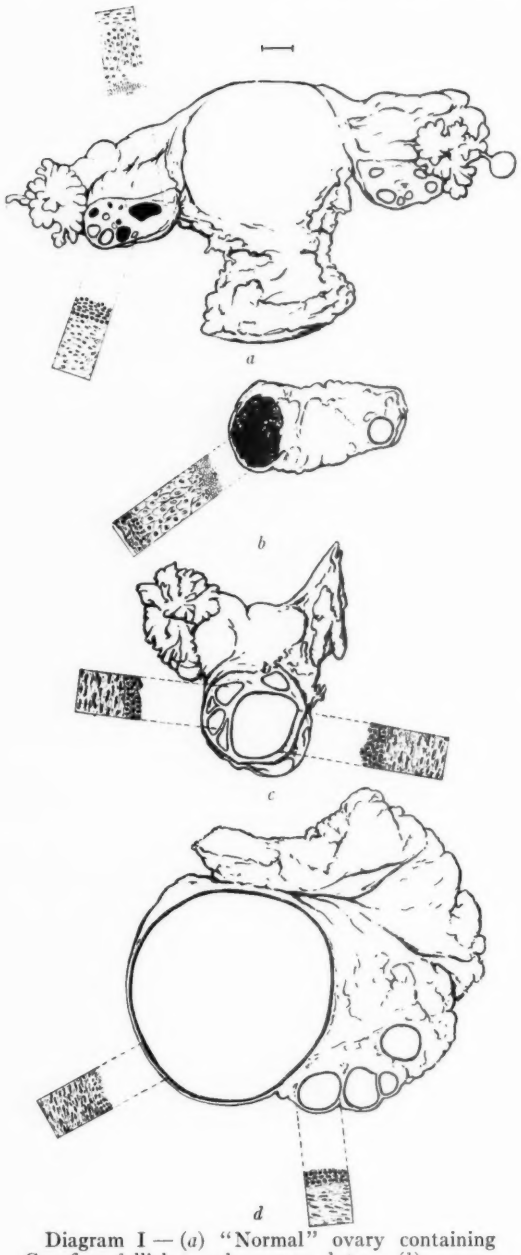


Diagram I — (*a*) "Normal" ovary containing Graafian follicles and corpora lutea; (*b*) corpus luteum; (*c*) simple ovarian cysts; (*d*) simple ovarian cysts.

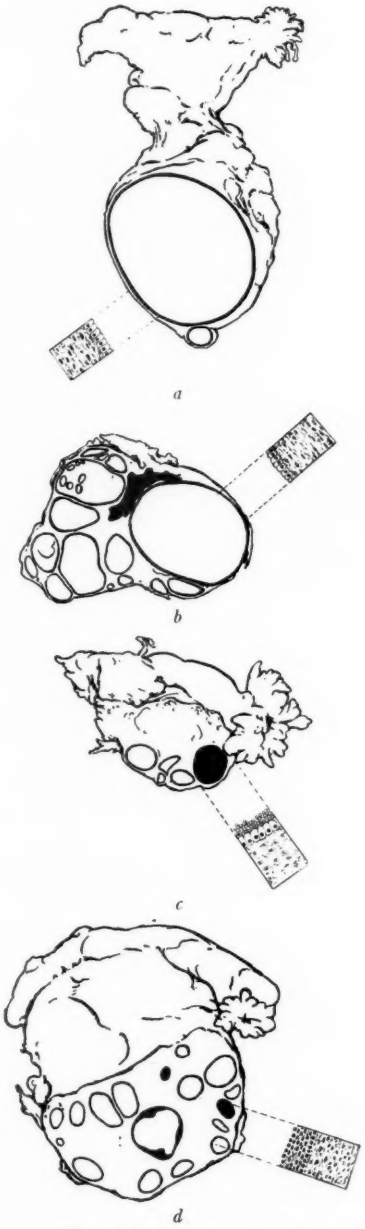


Diagram II — (*a*) Ovarian cystadenoma; (*b*) extracystic hæmorrhagic cystadenoma; (*c*) intracystic hæmorrhagic cystadenoma; (*d*) intracystic hæhmorrhagic simple cysts.

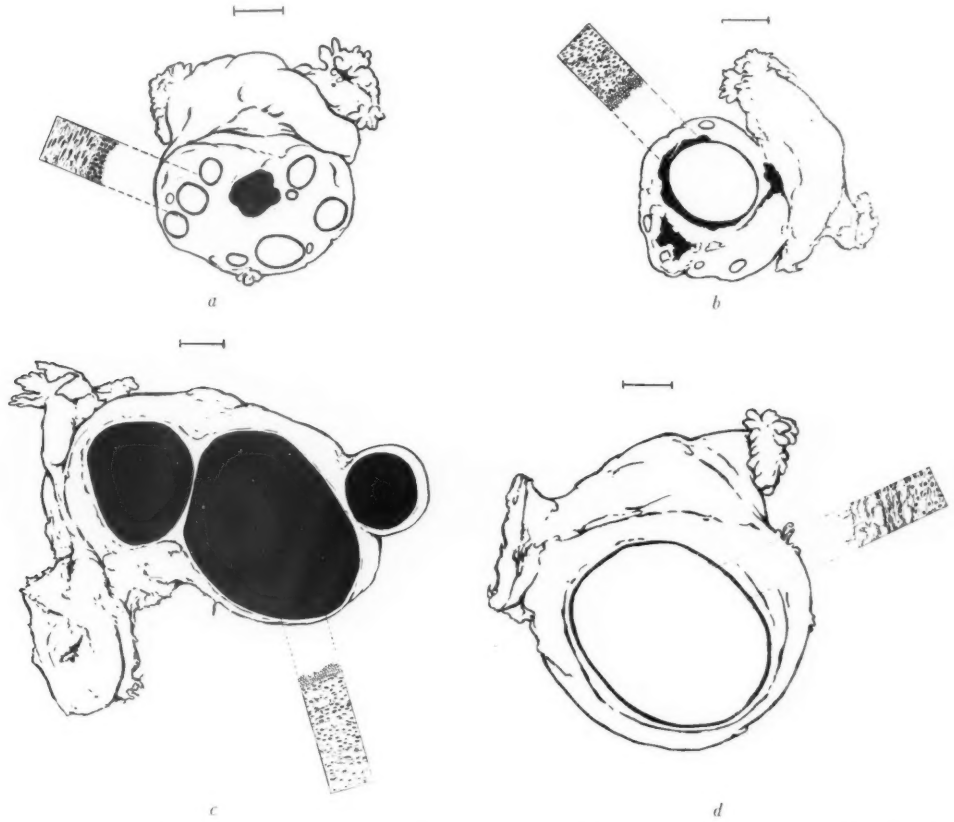


Diagram III — (*a*) Intracystic hæmorrhagic simple cysts; (*b*) extracystic hæmorrhagic cysts (type unknown); (*c*) intracystic hæmorrhagic cysts (tarry cysts — origin unknown); (*d*) large cyst with fibrinous contents (type of cyst unknown).

sists of many layers of round or oval cells, which rest upon the outer columnar row. The fourth picture (Fig. 21, *d*) presents a cyst wall lined by columnar epithelium.

This series of specimens is very striking, in view of the behavior of the mammary epithelium. It is especially interesting when associated with another case in this series (Fig. 10), which shows the lining of a single cyst, which presents three distinct features, i. e., the many-layered epithelium of the Graafian follicle and simple cyst, the columnar epithelium of the cystadenoma, and the papilloma of the intracystic papillary cystadenoma.

These facts suggest a process the stages of which have been termed entities. All unruptured follicles, most probably, do not pass through all stages, just as all cysts of the breast do not become cystadenomata. These observations do not interfere with the possibility of origin of cystadenomata from Pflüger's tubules, Wolffian tubules, or Wolffian rests.

In view of these facts, certain clinical and operative questions arise.

1. When operative procedure consists of artificial rupture of a cyst without removal, what are the chances of rupturing a cystadenoma? This question may be answered by

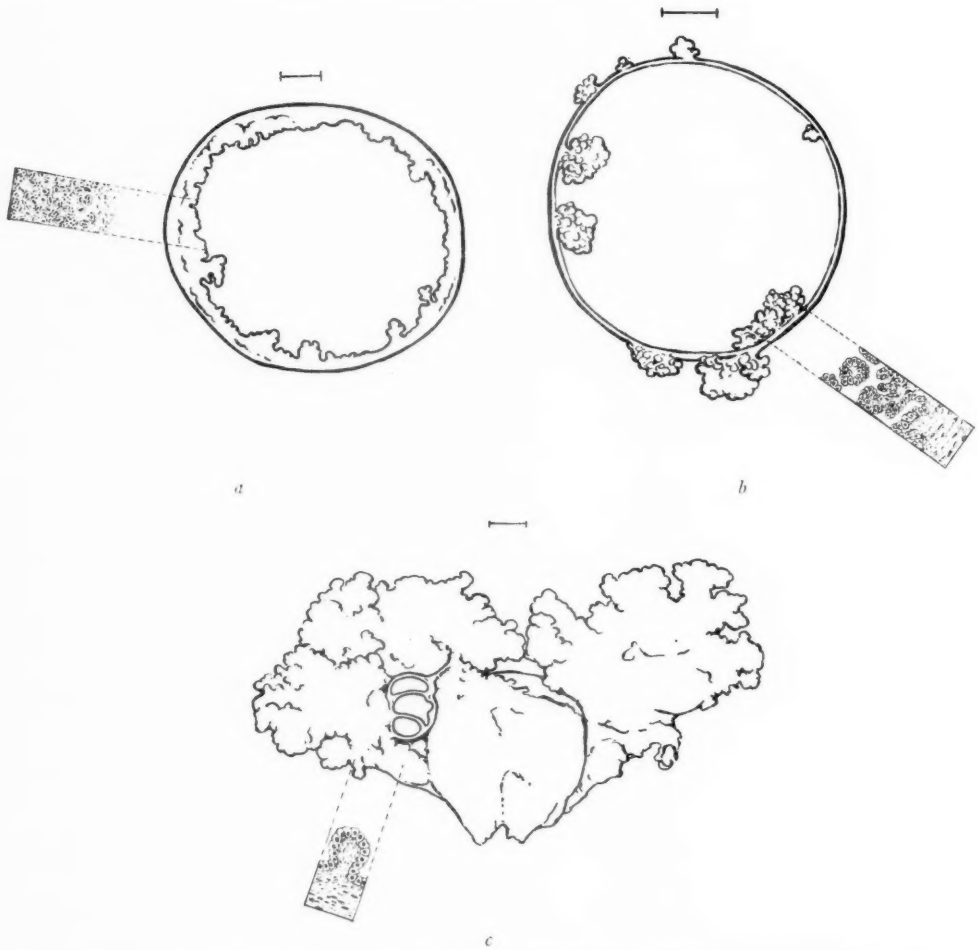


Diagram IV — (*a*) Ovarian abscess; (*b*) intra- and extracystic papillary ovarian cystadenoma; (*c*) bilateral extracystic papillary ovarian cystadenoma.

saying that small ovarian cystadenomata occur in a hæmorrhagic or non-hæmorrhagic state (Figs. 8, 9, 11), and that their differentiation from simple hæmorrhagic or non-hæmorrhagic cysts is determinable only by the microscope.

2. Would the artificial rupture of a small ovarian cystadenoma prevent further development? This is important, but is unanswerable at present. Experience teaches that large cystadenomata, however, certainly continue to develop after rupture.

3. In young individuals with cystic ovaries which the surgeon ordinarily removes or punctures, would it not be more conservative to determine the exact microscopic nature of a portion of the cyst wall during operation? By so doing a simple cyst may be ruptured without destruction of an ovary and cystadenomata will not be left in an attempt to conserve ovarian tissue.

REVIEW OF THE LITERATURE AND CASE REPORTS OF RUPTURED UTERUS

By C. H. DAVIS, M. D., Chicago
Resident in Obstetrics and Gynecology, Presbyterian Hospital

FOUR complete ruptures of the pregnant uterus have been treated at the Presbyterian Hospital during the past twelve years. Through the courtesy of Dr. Webster, I am reporting three cases which I saw in the operating room, together with a fourth which was reported in 1901. As a basis for this report, I have reviewed most of the literature since 1846, and have gathered some rather interesting statistics regarding this most appalling complication. Most cases of rupture are probably incomplete at first, but not recognized until after the rupture of the peritoneum. The statistics of complete and incomplete rupture must be considered together if we would make a fair comparison.

FREQUENCY OF RUPTURE

The frequency of uterine rupture varies in different parts of the country, being most common where the percentage of pelvic deformities is highest. In the Moscow Maternity there were 124 ruptures in 118,581 cases confined. Of these, the rupture was known to be complete in 58 cases and incomplete in 43. In 23 cases the extent of the rupture was not determined. At the New York Lying-in Hospital there were 75 ruptures in a series of 60,000 cases. Of these, 46 were complete and 39 incomplete. It is impossible to secure accurate statistics regarding the frequency of this complication, as in hospital practice we see the complicated cases of a large number of physicians and midwives without having any record of their normal confinements. On the other hand, many cases undoubtedly occur which are not diagnosed, the death being assigned to other causes. At the Moscow Maternity there was one rupture in 956 confinements, and at the New York Lying-in Hospital one rupture in 800 confinements. At the Royal Maternity Charity of London, from 1827 to 1856, Ramsbotham found records of only 8 complete ruptures in a total of 48,996 cases confined, or one in 6,124 cases. A few statistics given by others are as follows: Koblanck found 1 in 462 labors; Winckel, 1 in 666 labors; Brandl, 1 in 1,200 labors; Jolly, 1 in 3,403 labors; Harris, 1 in 4,000 labors; and Lahmann, 1 in 2,333 labors. The highest record we have found is from the Maternity of Bucarest, where there were 77 ruptures in a series of 23,016 cases, or one rupture in every 400 cases. In these statistics the high frequency refers to both types of rupture, whereas the low reports refer only to complete ruptures. It is also worthy of note that the low records are from the earlier papers, written at a time when comparatively few cases were referred to the hospital.

ETIOLOGY

There are certain conditions which may be considered as predisposing to rupture. It is more common in multiparæ. Brandl states that the proportion is 8 to 1. Trask reports 31 primiparæ in 417 cases; Jolly, 37 in 455 cases; Merz, 14 in 230 cases; Petrén, 4 in 54 Swedish cases; and Cristeanu, 4 in 77 cases at the Maternity of Bucarest.

We may briefly classify the predisposing causes as follows:

1. *Uterine:*
   - (*a*) Retraction ring.
   - (*b*) Prolonged or dry labors.
   - (*c*) Cicatrices following Cæsarean section, previous rupture, or trauma.
   - (*d*) Placenta prævia.
   - (*e*) Degenerative changes in the musculature.
   - (*f*) Hydramnion.
   - (*g*) High amputation of the cervix.
   - (*h*) Fixation operations.
   - (*i*) Congenital hypoplasia of the uterus.
   - (*j*) Tumors of the uterus.
   - (*k*) Anomalies as "uterus duplex" and "uterus unicornis."
   - (*l*) Anteflexion of the uterus, with diastasis.
   - (*m*) Congenital and acquired stenosis of the cervix.

(*n*) Hydatiform degeneration and thinning of the wall.

2. *Fœtal:*
   (*a*) Deformity of parts, as hydrocephalus or monstrosity.
   (*b*) Malpositions and malpresentations, as transverse, face, or brow.
   (*c*) Large fœtus or twin pregnancy.
   (*d*) More frequent with male than female children.
3. *Pelvic:*
   (*a*) Contracted or deformed pelves.
   (*b*) Obstruction of the pelvic canal by new growths or prolapsed organs.
4. *Vaginal:*
   (*a*) Stenosis, accidental or congenital.
   (*b*) Incomplete septum and bands.
   (*c*) Exceptionally tetanic contraction of the levator ani muscles.
5. *Intra-uterine manipulations:*
   (*a*) Manual or instrumental dilatation of the cervix.
   (*b*) Instrumental deliveries—all types.
   (*c*) Version.
   (*d*) Manual removal of placenta.

Spontaneous rupture is less common than the traumatic. Trask considered that it was spontaneous in at least 67 cases in his series of 417; Lobenstine reports 20 in his series of 46 cases. Spontaneous rupture is usually due to a diseased condition of the uterine wall or an extreme retraction of the upper uterine segment with corresponding thinning of the lower. Ivanoff made a histological examination of the uterus in 19 cases, studying the muscular, elastic, and connective tissue. He was unable to explain the rupture on the basis of the histology, although he found considerable variations in the percentage of elastic and connective tissue. Bauereisen has observed telangiectic changes in the lower uterine segment, and believes that careful histological studies will show this a more frequent condition than inflammation, sclerosis, and fatty changes. He also noted the scarcity of elastic and connective tissue in the vicinity of the rupture.

TRAUMATIC RUPTURE

The uterus is particularly liable to injury during pregnancy, owing to its size, position, and distended condition. It is subject to all sorts of contusions and pressures, but there is usually little or no injury, owing to the greater elasticity, mobility, and the amniotic fluid which equalizes the pressure. Rupture has occurred from all sorts of trauma—a fall, a kick, goring by a bull, and muscular exertion. Under muscular exertion we must consider all conditions which may cause a sudden contraction of the abdominal muscles, violently forcing the uterus against the vertebral column, as sneezing, coughing, vomiting, or the lifting of heavy objects. Such ruptures may occur with an overdistended or diseased uterine wall. Overdistention may result from hydramnion, twin pregnancy, or an unusually large fœtus. A diseased wall may result from carcinoma or other new growths, weakened Cæsarean section scars, a former rupture, or degenerative changes in the uterine muscle. The use of ergot in delayed labors has caused a number of ruptures.

Ergot was given previous to the rupture in 16 cases collected by Trask, and was, he thinks, responsible in at least 5 cases. Rupture, however, usually results from ill-advised or faulty manipulations. Any instrument used in delivering the child must be used advisedly and with great care. Undoubtedly unskillful use of instruments, manual procedures, and failure to recognize the dystocia are responsible for most ruptures. The danger of uterine rupture is in inverse ratio to the skill of the accoucheur.

Contracted or deformed pelvis were found in the following porportions:

Trask, at least	74 cases in	417, or	17.74%
Ames, at least	15 cases in	100, or	15 %
Brandl, at least	19 cases in	32, or	60 %
Merz, at least	70 cases in	230, or	30.43%
Von Winkel, at least	11 cases in	17, or	64.7 %
Fritsch, at least	388 cases in	500, or	77.6 %
Lobenstine, at least	21 cases in	46, or	44.65%

Hydrocephalus was found by the various writers in the following proportions:

Trask, at least	12 cases in	417, or	2.87%
Ames, at least	6 cases in	100, or	6 %
Brandl, at least	3 cases in	32, or	9.37%
Merz, at least	18 cases in	230, or	7.82%
Ivanoff, at least	4 cases in	124, or	3.22%
Lobenstine, at least	1 case in	78, or	1.28%
Cristeanu, at least	4 cases in	77, or	5.19%

Ames quotes Keith as finding 16 cases of rupture in a series of 74 cases of hydrocephalus collected from the literature.

SITE OF RUPTURE

In Trask's series, 17 cases occurring during pregnancy involved the body and fundus, and 8 the cervix. Of the ruptures occurring during labor, 110 involved the cervix, 17 the fundus, and 71 the body of the uterus. Radford, cited by Ames, in examining 19 cases found the location of the rupture to be longitudinal in 11, transverse in 3, oblique in 3, and circular in 2. Ames states that in his series it was posterior in 24, anterior in 15, on the right side in 13, and on the left in 9. Lobenstine, in 26 vertical tears, found 18 on the left side, 6 on the right, and 2 mesial. Sauvage, cited by Lobenstine, in a series of 36 complete ruptures found longitudinal tears 21 times and transverse 15 times. Franz reports 10 cases, with 6 transverse tears of the anterior wall and one of the posterior, 2 longitudinal lacerations of the cervix involving the body, and one transverse, of the vault of the vagina. Hinterstoisser states that rupture from indirect trauma is more frequent than from direct, and that in these cases the uterus ruptures lengthwise in the anterior wall of the fundus. Two varieties of incomplete rupture are described: rupture of the lateral wall into the folds of the broad ligament but not involving the peritoneum, and the so-called peritoneal fissures of Sanger, which may occur in either the anterior or posterior walls.

We find that during pregnancy the rupture involved the body or fundus in 68 per cent and the cervix in 32 per cent of the cases collected by Trask. Of the cases occurring during labor 55.5 per cent involved the cervix, 8.5 per cent the fundus, and 36 per cent the body of the uterus. If we omit the vaginal vault case of Franz and include our 4 cases, of which 3 were on the left side through the cervix and one involved the body and fundus, we have 379 cases in which the site is mentioned. Of these, 53.8 per cent involved the cervix and 46.2 per cent the body and fundus.

PREGNANCY AFTER RUPTURE

There are many cases on record where the woman became pregnant after rupture. Trask includes 9 cases, 3 of which had second rupture. Two of these women died; the third was saved by second laparotomy. Five women had one or more normal labors, and in one case the result was not given. Wenzel reported a case where the woman had two miscarriages, at the seventh and sixth months, later carrying a child to term but dying from a spontaneous rupture through the old scar area. He also cited a case of D. W. Moore in which the woman had a rupture through the old cicatrix in a subsequent pregnancy and recovered. McLean delivered his case without accidents, one and a half years after the rupture. Wood reported a case in which the rupture was discovered 17 days after delivery. The gut was returned to the abdomen, the rupture repaired, and subsequently the woman became pregnant. Kriwski had a rupture in the sixth and the seventh pregnancies without obvious cause. Mikhine cites Battlehner as having three consecutive ruptures in one woman, and Rose had four ruptures in one patient. In reviewing the literature he found 13 cases of second rupture, and states that at least six of the women died. W. Stroganoff has followed two cases in which a complete uterine laceration was sutured. Both women became pregnant and were delivered without accident. He advises that these cases be kept under very close observation during the last two or three months of pregnancy, and advocates delivery by version owing to the weakened uterine wall. The site of the former rupture should be palpated after delivery. We believe that Cæserean section or the use of forceps is safer than version in these cases. Version, however, is rarely given as the cause of rupture, only two cases being recorded in Trask's series of 417.

RUPTURE AFTER CÆSAREAN SECTION

Rupture of the uterus following Cæsarean section was very common before the advent of modern surgery. Brodhead cites the fact that "Kurkenberg in 1886 stated that, after the old operation, 50 per cent of all cases resulted in rupture of the uterus in subsequent pregnancies;" while on the other hand Ölshausen stated that they had only one scar rupture after at least 120 Cæsarean sections performed according to the modern

methods. In the old days sepsis nearly always followed the operation, and the muscular tissue about the scar became more or less degenerated. Harrar, after reviewing the records of multiple section at the New York Lying-in Hospital, says: "Out of 50 instances of the multiple operation the old scar was either not found at all, or when noted was solid in 42; four times it was attenuated in form; twice there was partial rupture at the location of the old scar, and twice complete rupture of the uterus." He made a microscopical examination of the tissue in three cases, and found that the rupture took place through apparently healthy muscular tissue but located between two old section scars. Couvelare states that the rupture occurs through an area of degenerated muscle along the edge of the scar. He considers that ruptures following section are due to anatomical condition of the scar, overdistention of the uterus, or the insertion of the placenta in the region of the cicatrix. The placenta was implanted upon the scar area in 5 or 6 cases in which the location is stated.

The probability of rupture following Cæsarean section is not great, and should not in the majority of cases be used as an argument in favor of sterilizing the women or performing the Porro operation. Section cases should be carefully watched during the latter months of subsequent pregnancies, and in the cases where there is some pelvic deformity, overdistention of the uterus, or a question of the integrity of the old scar area, Cæsarean section should be performed several days before the expected onset of labor. The work of Harrar and others would indicate that it is best to remove the old scar. Should a patient go into labor on whom a Cæsarean section was performed, but in whom there are now no indications other than the history of a section, she should never be allowed the strain of the second stage. The delivery should be by forceps or version if Cæsarean section is not performed.

UNUSUAL CASES

Jewett reported a case where one of twins was born spontaneously, while rupture occurred before delivery of the other. Recovery followed hysterectomy. West and Watson have each reported a case of rupture in a bicornuate uterus. Albers-Schönberg reported a case where a kidney prolapsed into the pelvis caused the rupture. Larinsky reported a case where an ovarian cyst was responsible. Hypes had a case where the rupture was due to violent vomiting. Freund reported a case where rupture was due to hydramnion, occurring just after rupture of the membranes. Trask found a case where a fit of anger and the exertion accompanying it was responsible. Several cases are on record in which the uterus was ruptured by the horn of a bull. Coe reported 3 cases where the child is said to have weighed over 14 pounds.

FŒTAL MORTALITY

At the Moscow Maternity the fœtal mortality in the entire series of incomplete and complete ruptures reached 87 per cent. In Lobenstine's series the fœtal mortality was 83 per cent in 46 complete ruptures and 52 per cent in 29 incomplete ruptures. In reviewing the literature we find that when the child was saved the rupture was either small or occurred during delivery of the child or placenta.

SYMPTOMS AND PHYSICAL SIGNS

There is a great variation in the symptoms of rupture. When it occurs during pregnancy, spontaneously or from external trauma, there is usually sudden and severe abdominal pain following some exertion or injury. But it may occur with the woman asleep in bed. The severe pain is usually followed by marked symptoms of collapse. When rupture occurs during labor, the patient may cry out in terror, during a pain, that something has given away or broken. This may be accompanied by a tearing or snapping sound. She usually has exceedingly sharp, agonizing pain in the region of the rupture. The pain may be colicky, burning, lancinating, or cramp-like. Uterine contractions soon cease; a numbness or dull ache persists; the patient becomes pale and shows marked signs of shock. She has an anxious look, rapid, feeble and often irregular pulse, increased respiration, and clammy skin. The temperature will

usually rise. The movements of the fœtus are often violent just before its death. The heart tones disappear, and the child can often be palpated free in the abdominal cavity while the uterus is firmly contracted at one side or in front. External bleeding may or may not take place. Death of the woman may occur in a short time, but she may live a number of hours or days.

The abdomen is tender and often distended. It may be round, due to the presence of amniotic fluid and blood, or irregular in contour, owing to the separate masses of uterus and fœtus in cases where little fluid is present and the child has escaped into the abdominal cavity. Pain may render palpation very difficult. Fluid blood can rarely be detected by palpation or percussion.

A vaginal examination will show that the presenting part has receded or disappeared; the cervix is drawn up and only slightly dilated. The uterine cavity may be found empty or filled with intestines. The site of the rupture can be palpated. Catheterizing will usually give sufficient evidence to determine the presence or absence of a ruptured bladder.

There are cases on record where the symptoms of rupture were so slight as to be overlooked, the condition being discovered accidently while operating for Cæsarean section. The symptoms are usually less marked in incomplete cases, hæmorrhage frequently being the most severe symptom. Many cases are undoubtedly never diagnosed.

PROGNOSIS

The prognosis of uterine rupture depends on whether it is complete or incomplete, its location, whether treated in a hospital with every facility or in the tenement, whether in the hands of a capable surgeon or a midwife, and on the nature of the treatment. It is very serious for both mother and child. The prognosis is less favorable with complete than with incomplete ruptures. The lateral tears are most serious, as they often involve the uterine artery. If a rupture occurs in a hospital, an early laparotomy should give a fair chance of recovery; but when it occurs outside, and the patient must be moved to a hospital or treated under unfavorable circumstances, most cases are fatal if the rupture is complete. Laparotomies give the best chances of recovery in all classes of cases. Tamponade and binding should be employed only as temporary measures or where an operation is impossible.

Attention has been called by several writers to the danger of moving a patient in whom there is a threatened rupture or in whom the rupture has occurred. De Lee reports one case where the rupture is supposed to have occurred on the way to the hospital. This may have been the case in two of our patients, but we have not sufficient evidence to make a definite statement in this regard.

DIAGNOSIS

The diagnosis is as a rule easy in the complete cases occurring during labor, owing to the presence of a number of the above symptoms and physical signs. The vaginal examination usually establishes the diagnosis. It is more difficult to diagnose the incomplete cases and those occurring during pregnancy. Rupture with bleeding may be confused with placenta prævia. Trask has included a few cases which were probably ectopic pregnancies. Webster warns us to bear in mind the complications which may exist with uterine rupture, i. e., prolapse and strangulation of the bowel, rupture of the bladder or rectum, escape of the liquor amnii with vernix caseosa and meconium into the peritoneal cavity, and septic infection.

TREATMENT

The predisposing and exciting causes of uterine rupture should be kept in mind and prevented whenever possible. With a diagnosis of rupture, there are three methods that have been followed in the past. A few cases have recovered with no treatment. The use of tamponade and binder is a method which may give fair results where the rupture is small or incomplete. But at the present time everyone is agreed that laparotomy gives the best results, and we believe, with C. Cristeanu and Draghiesco, that it should be performed in every case, as it is frequently impossible to tell otherwise whether the

rupture is complete. They advocate total abdominal hysterectomy and vaginal drainage for all complete cases.

Petrèn, in analyzing 754 cases, found that of 501 treated conservatively there were 361 deaths, or a mortality of 72 per cent; while in 174 cases operated on there were 92 deaths, or a mortality of 53 per cent. He was presumably considering complete rupture of the uterus, but has included the 124 cases from the Moscow Maternity, 43 of which were known to be incomplete. Of the 347 uncomplicated cases reviewed by Klein, 149 were operated on with a mortality of 44 per cent; 198 were treated conservatively with a mortality of 52 per cent. At the Moscow Maternity all of the cases were treated conservatively with tamponade and binding. In 23 cases, 3 of whom lived, the extent of the rupture was not determined. There were 58 complete ruptures with a mortality of 88 per cent, and 43 incomplete with a mortality of 62 per cent. After making a careful study of the literature and their own results, Ivanoff concluded that laparotomy gave twice as favorable results as the conservative methods.

CONCLUSIONS

The data presented in this paper can be briefly summarized as follows:

1. Rupture of the uterus is probably a more frequent complication of pregnancy than is indicated by the statistics of the earlier writers.

2. The difference between complete and incomplete rupture is one of degree. It is probable that most ruptures are at first incomplete.

3. As complete rupture increases the shock and danger from all hæmorrhage and sepsis, it is the more dangerous complication.

4. The rupture involves the lower uterine segment and cervix in at least 53.8 per cent of cases, the rent being more often on the left side and frequently involving the uterine artery.

5. Certain ruptures may be prevented by close observation of the case during pregnancy and by "good obstetrics."

6. A considerable number of ruptures follow Cæsarean section. A woman who has had a Cæsarean section should be confined in a hospital in subsequent pregnancies, preferably by a section shortly before term, as we cannot know the condition of the scar area.

7. Tamponade and binder is a good temporary measure and may give good results in the incomplete cases where there is little hæmorrhage, but in all classes of cases operative treatment gives better results than conservative and should be employed when ever possible.

CASE 1 (previously reported by Dr. Webster and Effa Davis). Mrs. S., Italian, aged 36, was admitted to the Presbyterian Hospital, Chicago, at 4 A. M., December 11, 1900. The first pregnancy was terminated by forceps; the next three were normal. In her fifth labor she was under the care of a midwife, who diagnosed a free presentation and called a physician at 10 A. M. He thought that everything was normal, and left. The woman had severe pains all day but made no progress. At 9 P. M. a second physician was called, who attempted forceps delivery. A third physician attempted version, but failed. A fourth physician reached the case at 2 A. M. She found the woman having vigorous pains, but with a weak, rapid pulse. Examination showed a face presentation with chin posterior, impacted at the brim of the pelvis. The patient was removed to the Presbyterian Hospital and Dr. Webster called. His examination showed a deep tear extending from the perineum through the whole extent of the vaginal wall on the left side, and this was continuous with a laceration which involved the cervix and the lower uterine segment. No fœtus could be felt in the uterus. The abdomen was greatly distended, the uterus being palpated as a firm, round mass bulging the lower portion of the abdominal wall anteriorly.

After administering saline solution, an abdominal section was performed. The fœtus lay free in the abdominal cavity with a quantity of fresh fluid blood. The uterine laceration involved the cervix, the lower uterine segment, and a small portion of the upper uterine segment on the left side. The posterior layer of the left broad ligament was entirely torn away, the rent being continuous with a deep tear which involved the vaginal wall. The fœtus and uterus were removed as quickly as possible, the pelvic cavity being packed with gauze, which was carried into the vagina. The patient rallied for a time, but died 16 hours after the operation as a result of hæmorrhage and shock. The fœtus was a male weighing a little over 10 pounds and was 55 cm. long.

CASE 2. Mrs. B., aged 37, third pregnancy; admitted to the Presbyterian Hospital May 26, 1910, at 8:30 A. M. Dr. Webster terminated her first pregnancy by Cæsarean section owing to a severe albuminuria, and Dr. Holmes delivered her second child with forceps. She came to the hospital alone and in a condition of marked toxæmia. She was

uncertain as to her name and address. It was impossible to secure any history of her former labors or this pregnancy. Her face was puffy and there was a marked œdema of the feet and legs. A catheterized specimen of urine contained a large amount of albumin and a considerable number of pus cells, but no casts. Owing to the extreme toxæmia a de Ribes bag was introduced. She began to have severe labor pains. Four hours later, as the pains were becoming tetanic in nature, she was taken to the operating room, the bag removed, and the cervix manually dilated under anæsthetic. The examination at this time showed a shoulder presenting, with the head on the left side. A dead fœtus of average size was delivered by version. When Dr. Culbertson introduced his hand to perform the version he palpated fibrous bands. The patient died just after the delivery. The fœtus was not macerated, but had probably been dead for some hours as the heart tones were not heard at any time.

Autopsy. The body is that of a well-nourished woman. There is a marked œdema of the feet and legs. On opening the abdomen the uterus is seen with a large irregular tear extending along the border of an old scar for a distance of 11 cm., and from the fundal end of the scar toward the left tube and coming within 1 cm. of it. The placenta is separated and lies in the torn area. A small amount of blood is seen in the peritoneal cavity. The liver is enlarged and shows fatty changes. The left kidney is larger than normal and on cut section shows evidence of chronic inflammatory changes. The right kidney is a mere pus sac. Anatomical diagnosis: rupture of the uterus, chronic interstitial nephritis, pyelonephritis of right kidney, and fatty degeneration of the liver.

We believe that this patient died from the extreme toxæmia and the degenerative changes resulting, rather than from rupture of the uterus. The anæsthetic and shock probably hastened death. In this case the toxæmia masked all the symptoms of threatened rupture. When asked regarding the abdominal scar she would only say "Operation," and as the pelvic measurements were normal a former Cæsarean section was not suspected. However, a section performed soon after her admission to the hospital could not have saved her, and the fœtus was already dead. This case shows the necessity of following cases throughout pregnancy.

CASE 3. Mrs. D., aged 35, second pregnancy, normal delivery with the first; was admitted to the Presbyterian Hospital in shock, November 21, 1910. In this labor her physician, in consultation with another, attempted to deliver with forceps after she had been in the second stage of labor for several hours and was beginning to show signs of exhaustion. As soon as the rupture was diagnosed she was placed on the train, brought some twenty miles to Chicago, and in an ambulance to the hospital. She was taken to the operating room in severe shock and quickly prepared for operation. Catheterization showed that the bladder was also ruptured. The abdomen was opened, under local anæsthetic, by Dr. Webster, and after clamping the uterine artery, 1,000 cc. of saline was given intravenously. The abdominal cavity was filled with clots and bright red blood. A hydrocephalic, spinabifidous fœtus lay free in the abdominal cavity. Urine, vernix caseosa, and meconium were mixed with the blood. A complete rupture of the uterus, 6 inches long, was found on the left side along the uterine artery, which was torn and bleeding. A rupture 2 inches long was found on the posterior surface of the bladder. The uterus was extirpated and the tear in the bladder repaired. The patient died from loss of blood and shock just after the closure of the abdomen.

CASE 4. Mrs. W., aged 36, sixth pregnancy; first five were prolonged but normal in other respects. After the fourth pregnancy she was in Michael Reese Hospital for repair of the cervix and perineum. The fifth child, an 8-pound boy, was delivered by the out-patient department of the hospital, after a labor lasting 36½ hours. The preliminary history made November 30, 1908, states that the perineum was relaxed from old lacerations and the cervix gaping but showing evidence of a repair. No new laceration was reported in the fifth pregnancy.

The patient began to have pains October 9, 1912, and after the escape of some water went to Michael Reese Hospital. Her pains stopped and she returned home the next day. October 12, she was at the Central Free Dispensary, where she stated that the pains were not severe and came every half-hour. The abdominal examination was made: liquor amnii apparently present, O. L. A. position, fœtal heart tones, 130 per minute. As she gave a history of prolonged labors and seemed to be in good condition, she was sent home and told to call the hospital when her pains became more severe. An interne called at her home the next day and reported her as having slight irregular pains. She began to have severe labor pains October 15, and called for a doctor at 7:30 A. M. The interne reached her home about 8 A. M. Her condition did not seem good: pulse was rapid, pains very severe and frequent, fœtal heart tones, 190. A vaginal examination disclosed a tear on the left side of the cervix about one inch long, poor effacement, and only moderate dilatation.

Considerable time was lost in persuading her to come to the hospital. She was admitted shortly after 10 A. M. and was seen a little later by Dr. Heaney, who diagnosed a rupture of the uterus and ordered her to the operating room. Dr. Webster opened the abdomen under local anæsthetic, but she died before the saline could be given. The body of the child had escaped through a rent which extended along the left uterine artery from the cervix well into the corpus, but the head was found engaged in the O. L. A. position. The placenta had not escaped. The pelvic measurements were practically normal. The child's head was average in size, and it weighed about 8 pounds.

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ABDOMINAL PREGNANCY WITH A LIVING CHILD[1]

BY J. SHELTON HORSLEY, M. D., RICHMOND, VIRGINIA

THE statistics of abdominal or extra-uterine pregnancy with a living child have been brought down to 1897 by Howard A. Kelly,[1] and Edward A. Ayres.[2] Kelly's statistics comprise 77 cases with viable fœtuses delivered by laparotomy from November, 1809, to November 7, 1896. Ayres brings the tables through 1897 and adds 14 cases not included in Kelly's table. This makes 91 cases. From 1897 to January 1, 1912, there have been 12 cases added, and one in 1897, evidently overlooked, making a total of 104 to 1912. In order to make the literature accessible, I will give brief abstracts of these 13 cases.

Case 1. Crouzat and Jeannel.[3] The patient was delivered of a well-formed male child, who lived 11 hours after the operation. The pregnancy had lasted about eight months. The placenta was not removed. The mother died from infection in the placenta one month later.

Case 2. J. B. Sutton.[4] The patient went to full term, and on operation the child was found alive, having escaped from the amnion, and was disporting among the intestines. The placenta was removed without difficulty. The child died from convulsions soon after delivery. The mother recovered.

Case 3. H. Tuholske.[5] The child was well developed and living when report was made. Placenta attached to liver and was not removed. Mother died 32 hours after delivery.

Case 4. W. L. Estes.[6] The pregnancy was at full term. The child was delivered living and was healthy at the time the report was made. The placenta could not be re-

[1] Operative Gynecology, ii. 458–459.
[2] Obstetrics, New York. 1899. i. 70.
[3] Rev. Obst. Internat., 1897. iii. 221.
[4] Obst. Tr., Lond., 1899, xl, 308.
[5] Tr. South. Surg. & Gynec. Ass., 1901, xiv, 38.
[6] Penn. M. J., 1903, vi, 393.

[1] Read before the Southern Surgical and Gynecological Association, at Old Point, Va., December 17, 1912.

moved on account of hæmorrhage. A marsupial operation was done. The mother died from infection thirteen days after the operation.

Case 5. H. W. Freund.[1] A full-term pregnancy. The child died six hours after delivery. The placenta was not removed on account of hæmorrhage. The mother recovered.

Case 6. Fournier.[2] The pregnancy had lasted about seven months. A well-formed child was delivered and lived half an hour. The placenta was removed after considerable hæmorrhage. The mother recovered.

Case 7. A. Sittner.[3] A full-term pregnancy. The child was living when the report was made. The mother recovered.

Case 8. E. T. Hargrave.[4] A full-term pregnancy. The placenta was removed. The child lived one hour. The mother recovered.

Case 9. Duff G. Lewis.[5] An eight-and-a-half-months pregnancy. The placenta was not removed. A deformed child was delivered and lived three days. The mother recovered.

Case 10. J. A. Allwood.[6] An eight-months pregnancy. The placenta was removed. The child lived three hours. The mother recovered.

Case 11. Weiss.[7] A full-term pregnancy. The placenta was removed. The mother and child both recovered.

Case 12. Geo. V. Lockett.[8] A full-term pregnancy. The placenta was removed. The child was normal and living 20 months after delivery. The mother recovered.

Case 13. John W. Lake.[9] A full-term pregnancy. The child lived 24 hours. The mother recovered.

Of the total number of 104 cases, there were 49 maternal deaths. A large proportion of this mortality occurred before the antiseptic era. In Kelly's table only two of the first twenty mothers were saved. In the thirteen cases collected from 1897 to 1912 there were three deaths. The recovery of the child, however, has not been materially affected by a septic surgery. The mortality of the child has been a relative thing, because this list only includes children that were delivered living. The vast majority of them lived only a few hours, or at most, a few days. Some of them were deformed. A few, however, survived. Probably a successful case can be gauged by the recovery of the mother and by the fact that a healthy child was delivered and was alive and well twelve months after the operation. From the cases where there are sufficient data given, we can select five that correspond to the requirements of saving the mother and the child living at least twelve months. There are undoubtedly several others that should be added to this list, but when reports are published giving details of such cases it is merely stated that the child is alive at the time the article was written. It is not entirely accurate to include such cases, for the article may have been written some time before publication.

I wish to add a case of my own to the list of abdominal pregnancies with a living child, which makes a total of 105 cases on record. In this instance both the mother and child recovered, and the child was living and well on December 17, 1912, more than a year after the operation. The history of the case is as follows:

H. L., colored, aged 27 years, from Brunswick County, Virginia, was referred by Dr. B. W. Dameron. Family history of no importance. The patient had been married ten years and had menstruated regularly except when pregnant. The first pregnancy resulted in a miscarriage at four months about nine years ago. The next child was born dead at full term, a year before admission to the hospital. The first menstruation missed since these pregnancies was in March, 1911. There was some slight bleeding in April and May, but since that time there had been no sign of menstruation. There were no pains in the abdomen until the onset of labor, and the patient had no reason to believe that the pregnancy was abnormal until labor began. On the first of December she had cramp-like pains around the navel, which were very severe. There was no pain in the back. The feet were slightly swollen. These pains continued and Dr. Dameron was called in.

[1] Samml. klin. Vorträg., Leipz., 1903–07, No. 448, 225.
[2] Bull. Soc. d'Obst., Paris, 1905, viii, 6.
[3] Deutsche. med. Wchnschr., 1906, xxxii, 1200.
[4] Va. M. Semi.-Month, 1907, xi, 317.
[5] Wash. M. Ann., 1907, vi, 315.
[6] Brit. M. J., 1907, i, 376.
[7] Zentralbl. f. Gynäk., Leipz., 1908, xxxii, 251.
[8] West. Canad. M. J., 1908, ii, 476.
[9] Boston M. & S. J., clxiv, 683.

He found the uterus empty, diagnosed abdominal pregnancy, and brought the patient to the hospital. She was admitted to Memorial Hospital on December 13, 1911, and referred to the obstetricians of the hospital, Doctors D. J. Coleman and M. L. Anderson, who confirmed Dr. Dameron's diagnosis and referred the patient to me for operation. When I saw her on the evening of December 13th, she was much exhausted by pains, with legs swollen and pulse 140. She was apparently at full term. A special clinic of senior students was called, and operation performed at 10 o'clock at night on December 13, 1911.

A long incision was made a little to the left of the middle line. The intestines and omentum tended to protrude. The anæsthetic was given lightly, as the patient's condition was considered dangerous and she was not throughly relaxed. After packing away the intestines and omentum, the baby was found lying largely to the left of the middle line and floating among the intestines, covered only by a thin membrane, which also surrounded the placenta. In order to save the child the delivery was accomplished as rapidly as possible. The head was towards the pelvis and was lifted up with the hand, at the same time rupturing the membrane. The cord was clamped and the child was given to Dr. M. L. Anderson for resuscitation. The baby was a boy weighing six pounds and had no deformity. There were a few adhesions of the intestines and omentum to the sac; these were separated and ligated where they were vascular. The placenta and the sac had a distinct pedicle from the left broad ligament. The pedicle was ligated and the placenta and membranes were removed. The condition resembled very much an ovarian tumor, in which the child and placenta might be said to constitute the contents of the tumor. The wound was closed in layers with catgut, and as there was some muddy fluid present, a drainage tube was placed in the cul-de-sac through a stab wound in the right flank.

The patient was returned to bed, with a pulse of 150. She was given saline subcutaneously and one or two doses of strychnine and sparteine. Her pulse gradually improved and she soon entered upon convalescence, with a temperature around 100, and pulse from 95 to 105. On December 24th, nine days after operation, she began to have more elevation of temperature, with pain in the right side directly over the point where the drainage had been placed at the time of operation. There was a mass and local rigidity. Blood count showed moderate leucocytosis. She was given hot douches and supportive treatment. These symptoms continuing and vaginal examination showing a mass in the cul-de-sac, a posterior vaginal section was done on January 2, 1912. No pus was discovered, but there was free oozing of blood. A rubber tube was fastened in the opening. From this time on her convalescence was satisfactory. There was a slight stitch infection of the abdominal wall, which healed readily. Mother and child were in excellent condition when discharged from the hospital on January 22, 1912, and both are well now, December 17, 1912, more than a year after the operation.

NOTE—Mother and baby were shown before the Southern Surgical & Gynecological Association on December 18, 1912. They were both in good health.

"PERICOLIC MEMBRANE" OF THE BROAD LIGAMENT

BY ARTHUR E. HERTZLER, M. D., KANSAS CITY, MISSOURI

MUCH has been written on the pathogenesis of the "pericolic membrane" in various parts of the body other than the colon, but so far as I know it has not been described on the broad ligament. I have observed it here for some years past in operations for varicocele of the pampiniform plexus. Inasmuch as the membrane in the various situations is due to like causes, its occurrence on the broad ligament is well worthy of study.

The condition is best presented by the discussion of a concrete case. A patient, 3 para, one abortion 6 months ago, presented a laceration of the perineum, a moderate rectocele and a pronounced cystocele. The cervix was just within the introitus. The fundus was large and retroverted. When the uterus was lifted up through an abdominal incision and the broad ligament was raised upon the finger, the following was noted: the veins forming the pampiniform plexus were large and their walls markedly thickened. They ran more or less parallel and were directed laterally from the uterus. Over these the peritoneum as usual could be freely moved. Within the substance of the peritoneum were numerous vessels, which formed a network, although the prevailing direction was from below upward toward the tubal mesentery. They were

about the size of a number one catgut or larger. They could be depleted by pressure and readily refilled when pressure was removed. The peritoneum was incised and lifted from the varicosed pampiniform veins. When this was done the plexus of vessels above described was lifted with it. Except where the dilated veins lay the peritoneum showed its usual transparent appearance. By very careful dissection anastomosis between the plexus of the peritoneum and the pampiniform veins could be made out. These caused a slight temporary oozing when the peritoneum was raised up. The pampiniform veins were doubly ligated and divided and the incision into the peritoneum was closed with Lembert sutures. With the removal of the dilated pampiniform veins the vascular plexus became less marked, not only immediately about the incision but also in regions where the peritoneum was not loosened.

I had an opportunity some years ago to observe the late effect of pampiniform resection on the dilated plexus in the peritoneum. A patient having a condition in the broad ligament similar to that described above was operated upon for an interstitial fibroid which was treated by bloodless hysterotomy with ligation of the broad ligament veins. I had occasion a year later to reoperate this patient for the purpose of doing an ileo-sigmoidostomy. The broad ligaments were examined and the peritoneal plexus of veins previously noted was not visible.

I have frequently produced this condition experimentally. The mesentery in animals is as transparent as the cornea except where the arteriæ intestini tenuis and their accompanying veins course. These clear spaces when treated with silver nitrate show fine plexuses of elongated endothelial cells. If any irritation is produced causing dilatation of the vessels normally visible, a capillary network becomes apparent in the area previously transparent. It is a mistake to assume that the process here is similar to that which occurs when vessels appear in the cornea as a result of irritation. In this structure there are no preformed vessels and when they appear from some irritation they arise by a process of budding, as so often described by the pathologists several generations ago. In the peritoneum these vessels already exist, though blood does not normally flow through them; but when an increased blood-flow to the part is demanded by some reactive process, or forced by stasis, they dilate and become the avenues of a collateral circulation or the receptacle of excess blood.[1]

That the condition of which the pericolic membrane is a special case is dependent upon fundamental principles in pathology (or shall we say adaptive physiology?) and not upon the inherent character of the peritoneum and its vessels is shown by the fact that conditions exactly analogous to those detailed for the broad ligament are seen in varicocele of the pampiniform plexus in the scrotum. I have seen it most marked, as one might predict, in severe cases of long standing. Here if one will take the time to expose freely the structures in question and isolate the veins with care one will see large veins outside of the pampiniform veins. I have seen these accessory veins, which normally are not visible to the naked eye, as large as a goose quill; though, unlike the vessels in the peritoneum, they do contain blood. These vessels when dilated as above described are readily seen through the skin and in fact do lie in the deeper layers of that structure and in the deeper tissues of the scrotum. I have noted for some years this association of dilated superficial veins with varicocele of the pampiniform plexus and it may confidently be stated that persons of mature years with unrelieved congestion of the deep veins will possess "pericolic" membranes in the region indicated.

The importance of these observations lies in the fact that they indicate that the changes in the peritoneum are problems in the pathology of the circulation. In a paper published some years ago I called the condition above referred to "varicosities of the peritoneum."

[1] These important but normally invisible channels are best demonstrated by injecting a 0.1 per cent silver nitrate solution into the thoracic aorta without opening the abdomen. The injection should be made as tense as possible. Half-grown animals are most easily injected. Fifty cc. of solution may be injected into a half-grown guinea pig. After the injection is completed the abdomen is opened and sections of omentum and mesentery are removed for microscopic study. The usually transparent and bloodless areas are seen to be traversed by a fine capillary network which the silver readily follows but which contains no blood under ordinary conditions.

For some cases that is the only term which describes the pathological changes present. In other cases hyperæmia of the peritoneum would be a better term. In temporary conditions it is the only term applicable. In the more chronic conditions where there are the same changes in the vessel walls as one finds in varicosities of the legs and in the pampiniform plexus, the term originally employed by me is warranted. The hyperæmias fall naturally into several classes. The condition described above in the broad ligament is of course a simple passive hyperæmia. In the more acute cases as seen about a subacute appendicitis it is in its inception active in that it is brought about by the demands of the reactive process. The vessels may contract and disappear when the focal lesion which called them forth disappears. On the other hand, when the dilatation is kept up for a sufficient length of time the vessels lose their power to contract and they remain permanently dilated, whether the initial lesion recovers or not. In the end stage it may be difficult to determine the history of a particular case, and a study of associated conditions only leads to the true explanation. In the case detailed above, in the broad ligament it is safe to say that the peritoneal veins were the result of a passive congestion. If the frimbriated extremities of the tubes were sealed and there were adhesions about the tubes and ovaries and there was an absence of factors causing passive congestion, such as old lacerations and displacements, it would be fair to assume that there was a primarily active dilatation which failed to contract after the relative recovery of the tubes.

The problem is one of pathology of the circulatory system and a study of Hunter and Thoma sheds more light upon it than the study of modern literature. The fundamental fallacy in clinical speculation is that surgeons have assumed that some grave crisis must have existed to bring about such results. A study of the pathology of the structures in question makes it clear that such is not the case. Dilated vessels in the legs and of the scrotum are not preceded by grave clinical disasters. In the peritoneum, too, slighter lesions are the ones that are followed by the dilatation, whether active or passive. Grave disasters are not the ones which are attended by the development of these vessels, as the instances quoted show.

Recently an attempt has been made to ascribe the condition to developmental anomalies. Unusual folds or an unusual development of normal folds may of course be the site of the development of these vessels but they cannot be the cause since they present nothing that could produce changes in the circulation. Perivascular changes resulting from stasis may cause normal folds to appear more prominent, but to consider them a result of such folds would be quite as reasonable as to ascribe varicosities of the legs to the œdema present.

Here as elsewhere it is illuminating to study the structure of the lesion present and to inquire if like lesions occur in other parts of the body. Whenever a lesion is discovered the genesis of which is in doubt the production of a similar lesion in the lower animals often sheds light upon the process. The lesions in the peritoneum above noted can be imitated in lower animals in sites where congenital anomalies do not come into question. A bit of sterile gauze thrust under the peritoneum will be followed by a typical "pericolic" membrane in the course of weeks or months.

The only congenital factor that comes into play are those inherent in the vascular system. Individuals with lax scrotums and long bellies or women with their pelvic organs at the introitus and their intestines in their pelves are very apt to have "pericolic" membranes. That individuals perfectly normal may develop these vessels is well known and is substantiated by their development experimentally in the lower animals. The fact remains that they are more prone to development in persons with a general laxity of the fibrous tissue in general and of the vessels in particular.

I have purposely avoided any reference to pseudo-peritoneal membrane. These are new formations, the result of exudative processes. These pseudo-membranes have been confused with "pericolic" membranes but this is unwarranted since their genesis is entirely different.

LENGTHENING SHORTENED BONES OF THE LEG BY OPERATION[1]

Ivory Screws with Removable Heads as a Means of Holding the Two Bone Fragments

By PAUL B. MAGNUSON, M. D., Chicago
From the Laboratory of Experimental Surgery, University of Pennsylvania.

THE possibilities of an operation for lengthening the long bones, especially those of the lower limbs, obviously depend on two things: First, the number of cases in which such an operation would be of decided benefit; second, the perfection of the technique of such an operation, so that its danger should be reduced to a minimum. The first of these conditions exists as a result of anterior poliomyelitis in childhood, preventing the full development of one lower limb, shortening after fracture, or in cases where injury to an epiphysis has taken place before maturity is reached. The first is by far the most common, and would seem particularly adapted to this treatment, since certain groups of muscles are atrophied, and there is less muscular force to overcome. According to Dr. de Forest Willard, the repair of bones affected by this disease is not retarded. The second class should be easily handled, for it would be merely a restoration of the tissues to their recently lost normal length. The third class, due to injury of the epiphysis, would be the most difficult, but it should be operable if the technique described later is as successful in operating upon the human as it has been in our experiments.

It was to prove that the technique could be made simple and the risk of such an operation be made small that this experimental work was attempted. The first problem was to find a method of cutting the bone and holding the two fragments in extension. The procedure used by Hopkins and Penrose (1) in 1889 hardly conforms to our present ideas of inducing regeneration. They cut the bone transversely, extended it, and into the ends of the medullary cavity inserted a bone peg which was held in place by transverse pegs. This blocked the ends of the medullary cavity and left no periosteum over the space between the fragments, making it impossible for new bone to be formed in the interspace. The plan adopted in our work was to make a median longitudinal incision in the bone and join it to the periphery with transverse incisions approaching the opposite ends from opposite sides (Fig. 1). In this way the bone could be kept in line; it gave a better chance to fasten both the fragments, and did not destroy the periosteum nor injure the endosteum and the bone would be as strong and straight as before the operation.

The next requirement was to devise some method of holding the two fragments in perfect apposition without allowing the slightest movement. It is not necessary to go into the details and failures of the different methods which were tried. Suffice it to say that silver wire would not hold against the steady pull of the muscles on the fragments unless twisted very tightly, and when this was accomplished the pressure caused necrosis of the surrounding bone, loosening of the wire, and finally its discharge through a sinus. Silver screws would hold the fragments, but also tended to produce softening of surrounding bone, letting the fragments slip back, and they had the disadvantage of a head protruding beyond the cortex of the bone, offering increased pressure to the soft parts.

Ivory pegs were next tried, but the callus growing from the medullary cavity separated the ends of the bone in less than three weeks. Ivory screws were then put on trial, but the first ones were made with fine threads which invariably broke off in the process of driving in. The experiments finally resulted in the use of ivory screws with deep V-shaped thread and removable brass heads, to which enough force could be applied to drive the screw in solidly (Fig. 2A).

[1] Read before the Chicago Surgical Society, January 10, 1913.

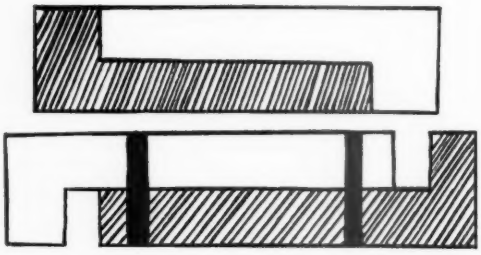


Fig. 1.

TECHNIQUE OF OPERATION

The technique followed was an incision through the soft parts over the inside of the tibia down to the bone; the periosteum was dissected away in a median longitudinal line, about three inches long, and wide enough to accommodate a circular saw with which the incision was made through the bone (Fig. 3A). A great deal of care must be taken in starting this cut, for a slip sidewise would destroy a considerable amount of periosteum. The

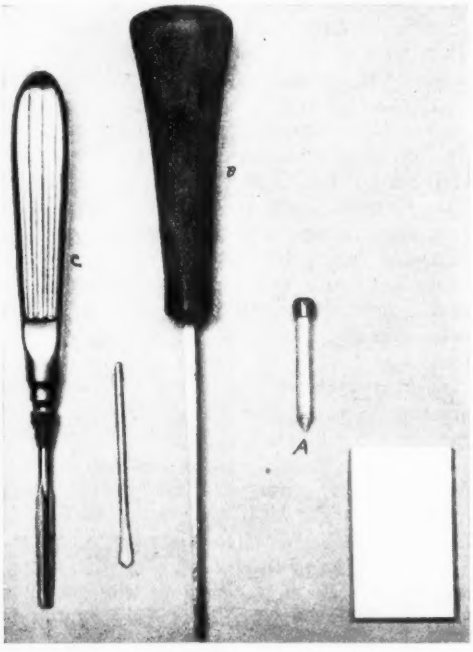


Fig. 2.

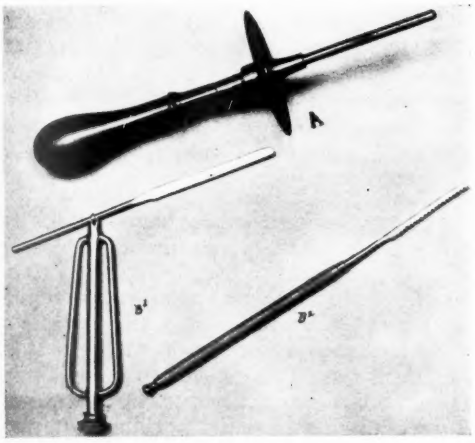


Fig. 3.

fibula was then stripped off the under surface of the tibia and broken with a small osteotome, which was slipped in between the bones. The fibula is a very rudimentary structure in the dog and is attached to the tibia by fibrous tissue. The cross incisions were then made with a blunt-pointed keyhole saw (Fig. 3B), and the few remaining small bridges of bone connecting the fragments were cut with an osteotome. In operating on the human I use a circular saw (Fig. 3A) with handle at both sides, and instead of an osteotome, which is rather thick, I use a carving chisel with very thin blade (Fig. 2B), as copied after Murphy.

To put weight on the fragments and drag them apart, hooks were used. These were caught in the angle made by the junction of the longitudinal and transverse incisions. The upper one was fastened to the head of the table and the lower one attached to weights by a wire run over a pulley at the foot of the table. Thirty-two pounds were used in all cases and one-fourth to one-half an inch of lengthening accomplished in from three to five minutes. Applying the extension in this way, the force is all exerted on the muscles attached to the two parts of the bone. The joints and soft parts above and below are saved from strain, and the stretching is accomplished more quickly. When the desired amount of extension was reached, a plug was

Fig. 4.

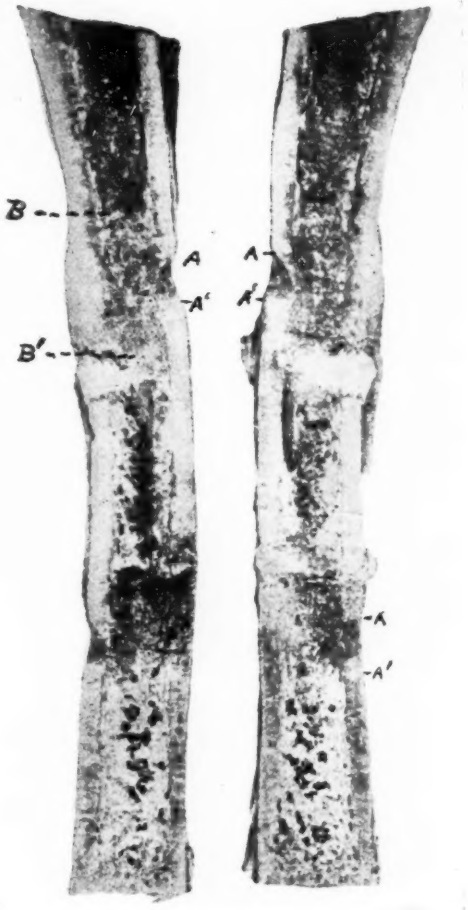


Fig. 5.

put between the ends of the fragments and the weights removed. After putting the fragments in perfect line, the holes, nine sizes (screw gauge) smaller than the screws, were drilled about half an inch from the end of each fragment. A tap (Fig. 2C), with thread the same size as the screw to be used, was put through to cut a thread in the bone; then the screw was inserted and both ends cut off flush with the shaft, leaving nothing projecting beyond the cortex. The interspaces were allowed to fill with blood and the wound closed with silk sutures, and dry dressings applied.

REASONS FOR USING IVORY SCREWS AND THE ACTION OF THE TISSUES ON IVORY

While the lengthening of bones was the original problem, the ivory screws developed in the course of experimentation seemed to give promise of value as a practical means of holding bone fragments in other operations. Ivory is strong enough to withstand muscular action exerted on the broken bone. It will not loosen or slough out, and when the operation is complete all projecting ends are cut off, leaving nothing to injure or irritate the soft parts. Subsequently the ivory is absorbed, leaving the healed bone as solid as before injury.

There is a great diversity of opinion in literature regarding the absorption of ivory, which seems to have arisen from two causes, which are (1) that ivory will not be absorbed unless very closely surrounded by living healthy bone; (2) that if any suppuration is present erosion does not take place.

In these experiments it was impossible to even find the location of the screws in two

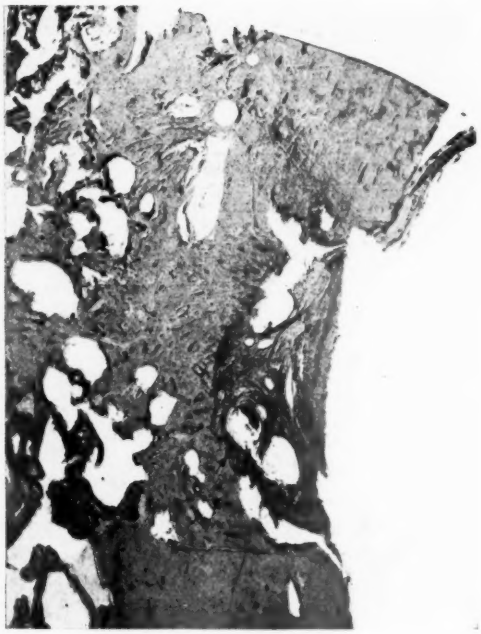


Fig. 6.

Fig. 7.

three-months' specimens, so completely was the ivory destroyed, and in no case was any erosion noticed if there was a suppurative process in the bone.

A microscopic study of the process of absorption showed in a four-weeks' specimen the screws unchanged in close contact with the cortex, but that portion which lay in the medullary cavity was much eroded (Fig. 4). The threads were eaten away and new spongy bone lay in very intimate contact with the ivory. In some places osteoclasts lay between the two substances and osteoblasts were much in evidence, but in numerous areas trabeculæ of new bone lay in close apposition to the eroded screw, with no cells of any character intervening. This suggested a possible chemical or digestive destruction, as well as mechanical breaking off of fragments.

STATISTICS

The statistics of sixteen operations on dogs were as follows:

In the first two operations where ivory pegs were used, callus growing from the ends of the medullary cavity pushed the fragments apart, which resulted in the wound being broken open and the bone exposed. These dogs were both killed in four weeks. Two died of distemper within two weeks. The fragments were adherent by callus, but no change of any consequence had occurred. Three were lost by primary infection. It may be apropos to say here that the strictest aseptic technique must be carried out, since at the end of each fragment there is a blood clot which communicates directly with the medullary cavity. Four dogs fractured their legs after operation. Of these, three were compound, and the dogs were killed. One united with angular deformity. Four were entirely successful. One went on to union with a sinus, which continued to discharge for about six weeks.

These figures do not at first glance seem to be encouraging, but if one takes into consideration the impossibility of immobilizing the dog's hind leg, the difficulty encountered in sterilizing the skin, and, finally, that the technique was all developed by the observation of mistakes instead of by reference to previous work done on the subject, the statistics do not in the least discourage us.

THE PROCESS OF REPAIR

A four-weeks-old specimen studied grossly showed the bone firmly united in the longitudinal incision, the line of incision being barely noticeable. The

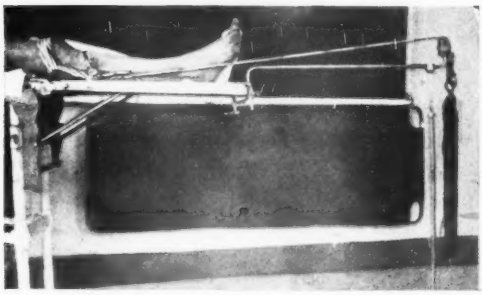


Fig. 8.

interspaces contained a hard, bony substance, almost completely filling them, which could not be broken away (Fig. 5). A thick layer of periosteum had grown over this substance and was adherent to it. On longitudinal section the medullary cavity opposite the interspace, and for about three-eighths of an inch on each side, was seen to be filled with a hard compact calcareous substance, which appeared to be flowing up into the interspaces. The screws were intact for the most part, only here and there threads were eroded, the bone cells having protruded themselves into the eroded area as the ivory was carried away, leaving the two substances still in close contact.

MICROSCOPIC REPORT OF REPAIR

Microscopically it was seen that repair was taking place, both from the endosteum and periosteum. The periosteum had grown over the interspace and was in close contact with the new bone, which had grown up into the space from the medullary cavity. Both structures had a rich blood supply and appeared to be working in unison towards one goal, the filling up of the interspace with new bone.

PRACTICAL APPLICATION

To consider the operation from a practical standpoint the anatomy of the parts to which it would be applied should be reviewed. The femur is obviously the most suitable location for operation. With the exception of the sartorius and gracilis, the tendons of the muscles which run from the pelvis to the knee are easily accessible and tenotomies can be done. The other muscles originating on the pelvis are attached to the upper half of the femur, except the adductors, which are inserted along the inner side down to the knee. The muscles originating on the femur and attached to the lower leg are located, for the most part, on the lower half of the femur, on the anterior and external surface. Only comparatively few fibers extend beyond these

Fig. 9.

lines. Taking advantage of these anatomical facts, a longitudinal incision should be started at the middle of the femur, between the adductors and the vastus internus, and extended down to the point at which the femur becomes larger in circumference to form the condyles. The longitudinal incision through the bone, considering the femur as a cylinder, would be at an angle of about thirty degrees, with the antero-posterior diameter, and in the long axis of the bone. The lower transverse incision will be made then on the internal surface and the upper one on the external surface, so that all the muscles on the upper fragment are attached to the pelvis, and nearly all those on the lower fragment to the leg, reducing to a minimum the amount of muscular resistance to be overcome. There has been some criticism of this operation on the grounds that the blood vessels and nerves would not stand the stretching process to any degree. I have, however, one case of a boy, fourteen years old, with a subtrochanteric fracture of the left femur, with two inches and a half of shortening (Fig. 7).

Fig. 10.

Fig. 11.

This boy came to me four months after the injury, reporting that while he was running upstairs he fell, striking his left hip on the edge of a step. A doctor was called in and diagnosed a dislocation of the hip, manipulated the leg, put the boy to bed without any apparatus, kept him there for about two weeks, and then allowed him to get up and walk around on crutches. The result was a shortening of the leg, by overriding of the fragments, a shortening of two inches and a half, and inversion of the foot, and a large amount of callus at the seat of fracture. It was between four and five months after the injury that the boy first came to me, and about two weeks after that he was sent to Wesley Hospital for operation. On making a lateral incision over the seat of fracture, I found that the upper fragment had been rotated posteriorly and abducted; that the lower fragment was pulled up, so that the upper end lay in front of and very close to the neck of the femur. A firm bony union had taken place between these fragments, filling in a V-shaped space with compact callus. My first procedure was to drive a thin-bladed carving chisel up between the fragments, separating them on the side. I then found that the callus extended around posteriorly and with a Lane forceps rotating the lower fragment inward, and another forceps on the upper fragment rotating outward, the chisel was driven down through the callus and liberated the fragments. After this was done (a Clove hitch of bed-ticking having been put around the knee previous to the beginning of the operation, with a pad in the perineum and counter extension applied by tying a strip of ticking to the head of the table), a rope was attached to the strip around the knee and run over a pulley extended from the foot of the table and upheld by a standard on the floor (Fig. 8). To the end of this rope sixty-five pounds of window-weights were attached and the soft parts stretched down, so that the end of the fragments could be accurately apposed without any manipulation inside the wound except to guide the fragments with a lever. After the stretching process, a Lane plate was applied, and the wound closed with catgut and silkworm gut, without drainage (Fig. 9). A single spica of the hip and leg was applied, and the boy put to bed. This is where I believe that a mistake was made since I did not put extension on his limb after the boy was put to bed. There was some slight angulation at the seat of fracture, and a coxa-vara resulted, which still persists (Fig. 10). The boy expects to go to the hospital within the next month, at which time we will do a subtrochanteric osteotomy, thus correcting the coxa-vara. This should not have been necessary, if we had realized in the first place that a spica of the hip would not hold the fracture solidly enough against the pull of the muscles. The plate was removed from this case in about eight weeks on account of a persistent discharge of sero-pus, although the boy was not running any temperature. After the plate was removed the

Fig. 12.

Fig. 13.

wound promptly healed, and although the patient has had many falls in playing first base on a baseball team all summer, he claimed to have had no pain in the hip and no disability. The coxavara is not getting any worse, but it is not a perfect result.

This case would indicate to me that we at least can get two and a half inches of lengthening in a femur without interference with the blood and nerve supply.

Dr. S. C. Plummer, had a case about a year and a half ago of a switchman, about forty-two years old, who had three inches of overriding of the fragments in a fracture of the femur six months old, in which the fragments were firmly united by callus. He stretched the muscles, nerves and blood vessels in this case by the same method used in the case just referred to, and brought the ends of the fragments into accurate apposition, the stretching process lasting between fifteen and twenty minutes.

I am sorry I am not able to show this case, since he died of acute alcoholism some time after the operation. He lived long enough, however, to determine that there was no interference with the blood or nerve supply in the operated limb.

In a case of recent fracture in a man, thirty-nine years old, which was spiral in shape, very oblique, and included part of the greater and lesser trochanters in each fragment, with one inch and a quarter of shortening, I stretched this fracture down into place in five minutes with seventy pounds of weight, ten days after the injury, and inserted one ivory screw through the fragments, which was all the retention apparatus that was needed in this case. However, I kept extension on this man for two weeks after the operation, having learned a lesson at a dear price from the first case reported. This man went home at the end of seven weeks with a perfect result (Figs. 11 and 12).

One more case in which ivory screws were used in retaining a fracture. J. M., aged fifty-two, fell from the top of a freight car, sustaining a fracture of the fibula and fracture of the internal malleolus of the left leg (Fig. 13). We were not able to reduce the fracture satisfactorily under an anæsthetic, and an open operation was made. In this case the oblique fracture of the fibula was held in place with a single ivory screw, a tenotomy of the tendo-Achilles was done to prevent any posterior dislocation of the foot, and the case put up in plaster (Figs. 14 and 15). In this case, as well as in the one just previously reported, the wound healed by first in-

Fig. 14.

Fig. 15.

tention, there was no discharge of serum, there never was any pain, and by palpation we cannot determine that there was ever any retention appliance inserted in these bones.

CONCLUSIONS

1. A shortened femur may be lengthened from two to three inches without any interference with blood and nerve supply, excepting in cases where there is a large amount of old inflammatory tissue which would limit the stretching of the blood vessels and nerves, or which might produce kinking.

2. Ivory, being an animal matter, is entirely absorbed by the tissues, does not act as a foreign body in bone, does not cause necrosis or slough out as do most other materials.

3. Ivory screws may be cut off flush with the shaft of the bone, leaving nothing to project into or irritate the soft parts.

4. There is no flange or shoulder on the screw to prevent it from entering to its full length. The method of application insures the screw fitting accurately, into the hole made for it, since a tap is put through first; the deep thread into the bone insures a good hold, prevents any lateral motion, and *the absorption of fluids by the ivory insures that in twenty-four hours the screw will fit so closely that it will not allow the slightest motion between the fragments.*

5. No great force is needed to drive the screws in, and eventually they will be absorbed, leaving the healed bone without defect.

6. In case of infection after the operation the ivory will not be absorbed until the suppuration has ceased.

7. Lengthening bones would be of benefit in shortening after fracture, faulty development, or injury to the epiphysis before full growth is reached.

8. The amount of extension obtained in these experiments was from three-eighths to one-half inch in dogs, about the size of a fox terrier, without the slightest injury to blood vessels or nerves, making it seem very probable that from two to three inches may be obtained in a bone as long as the average

human femur, without any serious after-effects.

It may be stated here that the method of sterilization of the ivory screws which we have found best is saturated solution of bichloride of mercury in alcohol, placed in the autoclave, under high steam pressure, for four hours. If these ivory screws are boiled they become warped and useless.

The experimental work for this paper was done at the University of Pennsylvania laboratories and published in detail in University of Pennsylvania Medical Bulletin in May, 1908.

A DESCRIPTION OF THE ENTEROPTOTIC WOMAN[1]

By RICHARD R. SMITH, M. D., Grand Rapids, Michigan

VISCERAL prolapse in woman is always attended by other structural abnormalities, with which it is bound in close association. The prolapse itself is but a part of the picture. In our study of the subject, or in an estimate of any individual case, these other abnormalities should receive the same consideration as the viscera themselves.

With this conception in mind we may divide our women with enteroptosis into two groups. In the one we place those who, during childhood and adolescence, were well nourished, were more or less sturdy of form and firm of tissue, who had deep chests, capacious upper abdomens, and retentive abdominal walls, but who now present, aside from these easily determined signs of a previous vigor, some degree of visceral prolapse, considerable relaxation of tissue, a changed configuration of body, and sometimes a loss of weight — indications to us of the ill health from which they are suffering. This is the so-called *acquired* form of enteroptosis.

In Fig. 1 we have a woman of this type. We note that she is well supplied with fat, is of stocky build, has a large capacious chest and an ample waist line, showing that fundamentally she is of vigorous type. She has, however, a prominent abdomen, a diminution of the lumbar curve of the spine, and round shoulders. Her tissues are soft, her right kidney is easily palpable, and the lower pole of her stomach is somewhat prolapsed.

The woman in Fig. 2 was originally of vigorous build — enough so that we may include her in this group. This is best shown in the size and depth of the thorax. She has lost considerable weight through a chronic pelvic infection. The abdomen is very prominent (a common feature of this group) and she has the same change in configuration of the spine and relaxation of tissues noted in the last figure, with also a slight lateral curvature.

In Fig. 3 we have an enteroptotic woman who also belongs to this group. She has marked muscular weakness and insufficiency, shown in the spinal curve, is somewhat emaciated and relaxed, has a fair degree of visceral prolapse and marked subjective symptoms. She is 28 years of age — a farmer's wife. The woman had been in satisfactory health during childhood and much of her girlhood and was well nourished. She married at 17, worked very hard, had several children and lived on insufficient food. She had headaches, was incapacitated for work and had a feeling of weight in the lower abdomen. She had gradually acquired the marked change in body configuration which we see here. This in brief is a characteristic history of women of this type. The strains that have caused their ill health are, we find, usually excessive. Very vigorous women do not usually give way under ordinarily favorable conditions; the best of them will do so if the strain is great.

I have shown you here the most conspicuous features of this group. Let me add that the symptoms of these women are often quite as

[1]Read before the Third Clinical Congress of Surgeons of North America, New York City, November 13, 1912.

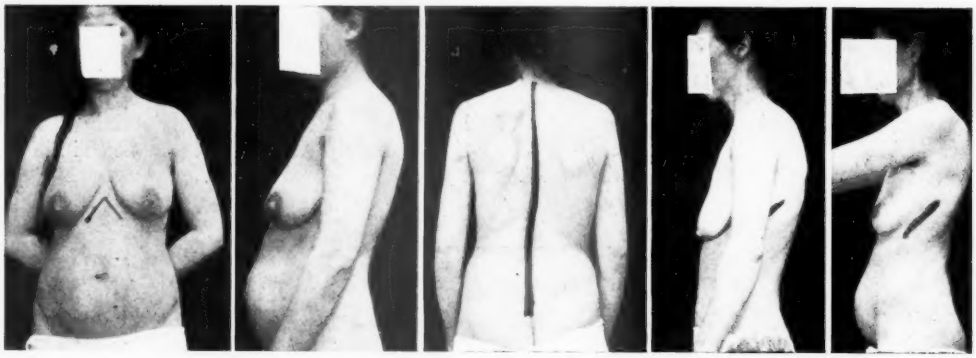


Fig. 1. Fig. 2. Fig. 3.

distressing as those of the second group which we are to discuss. The prolapse is on the whole much less in degree; the relaxation and signs of muscular insufficiency are often quite as great.

We now dismiss the first group and turn to the second, made up of those who from childhood up have presented certain defects in body structure — the so-called *congenital* form of enteroptosis.

In Fig. 4 we have a good example of this. We note in such a form that it is frail, has little fat, that the tissues are soft and relaxed, and that the whole body is wanting in vigorous development. We may, I think, call these the *fundamental* or *primary* characteristics. Women of this group form a distinct type. Note in this figure also the size of the chest and the length and contraction of the middle zone of the trunk. These women may be short or tall; they are, of course, of much less than the average weight. The neck and limbs are as a rule longer than usual.

The slenderness of the whole body is well illustrated in Fig. 5 by a comparison of these two figures. Note the compact, vigorous form of the one on the right, then the one on the left.

I have spoken of the primary or fundamental characteristics of this habitus. We often see also in such women signs of muscular weakness or insufficiency. In Fig. 6 we have a normal figure in the erect military position. This is shown you in order that you may compare it with those that follow.

In Fig. 7 we have a number of well marked instances of weakness and muscular insufficiency. The most conspicuous ones show themselves in round shoulders, a diminution of the lumbar curve (which in the middle figure amounts to complete eradication), in more or less prominence of the abdominal walls, and in flatfoot. Muscular weakness — an inability to meet the work or strain placed upon them — plays the most important rôle in the causation of these deformities, though other elements — structural weakness in the supporting ligaments — are, of course, important. To us such deformities commonly express fatigue — an easy consequence in these frail individuals of overwork, childbearing, the responsibilities of the home, indoor living, poor hygiene, or any of the diseases which seriously affect the tone and nutrition. They are valuable guides in the estimate of the health of the individual in question. These commonplace deformities take on a new interest when studied in connection with enteroptosis. They are in general much less fixed than those, say, of the chest; they reflect more nearly the state of the woman's health. There is a tendency to betterment as the patient improves in health, even when receiving no specific treatment. They are not peculiar to women of this type (I have shown you them in the other group), but they are exceedingly common among them. These muscular insufficiencies, with the faults in attitude and structure which they induce, are undoubtedly responsi-

Fig. 4.

Fig. 5.

Fig. 6.

ble for much of the backache, pain in the sides and other parts of the body which these individuals frequently have. Dr. Goldthwaite will, I presume, discuss this phase of the subject, and I call attention to it merely to emphasize its importance. In the worst instances of prolapse these deformities are practically always present.

In Fig. 8 is a woman of this habitus of lesser degree, showing little signs of insufficiency. She is in good health and maintains a good attitude. Her right kidney is palpable and the lower pole of the stomach is found well below the umbilicus.

The thorax in the study of enteroptosis is of special interest to us, for the capacity of the abdominal portion is not only a factor (though by no means the only one) in determining the position of the abdominal viscera, but in its size and shape it gives us much important information as to the woman's natural vigor and her early nutrition. We may say in this instance, for example (Fig. 9), that she was poorly nourished for a long period of her childhood and adolescence. Compare her chest (on the left) with that of an ordinarily vigorous woman (on the right); note the difference in size, shape and depth.

In Fig. 10 we see this same chest from different angles, showing its shallowness, the sharp slant downward of the lower ribs, and its narrow epigastric angle, all very characteristic of the women of this congenital group and distinguishing them perhaps better than anything else from women of the first group. Such a chest is always accompanied by visceral ptosis. What is more, if the inspection of such a chest is accompanied by an examination of the walls of the abdomen, to note their degree of relaxation, one may tell with considerable accuracy the degree of prolapse which she has. In this group, where the prolapse is greatest the abdomen is flat, or comparatively so, though child-bearing is apt to increase its prominence somewhat. The prominence is greatest at its lowest portion, as is shown in the middle figure.

This woman will form a convenient case for a brief reference to the viscera. The tube was placed at six feet and a rapid exposure made, so that the radiographs are practically orthodiagrammatic.[1]

In Fig. 11 we have a plate [2] taken with the patient lying on the back, immediately after a bismuth meal, and shows the stomach so well known to you as typical of enteroptosis. It is at present in a state of moderate contraction. A picture taken in this position does

[1] This method gives us an accurate idea as to the degree of prolapse since there is little distortion from having the tube placed too near. It is not to be recommended for constant use, since it is destructive to the tubes and apparatus.

[2] For better demonstration, drawings accurately measured from the plates are shown.

Fig. 7.

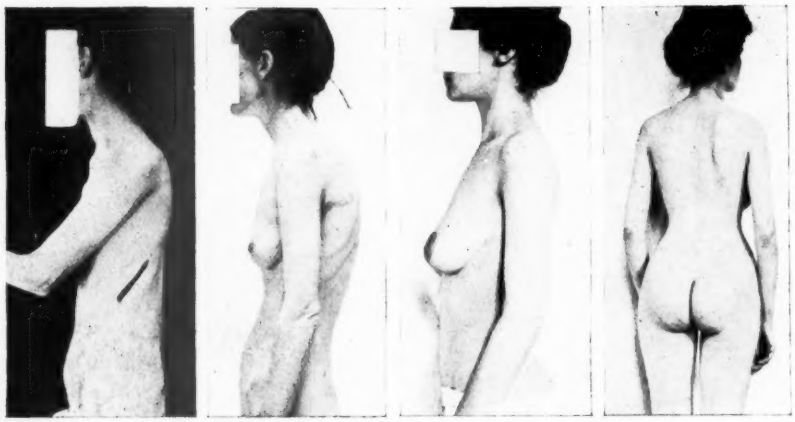


Fig. 8.

not show the extent of relaxation possible in such a stomach. In another plate, unfortunately spoiled, there was shown a sinking of the hepatic flexure and a marked prolapse of the transverse colon. The splenic flexure remained in place as is the rule, though not an invariable one.

Fig. 12. This is the same stomach taken in the upright position and shows the lower pole fully four inches or more below the one taken in the lying position. This atony, allowing such stretching out of the walls, is typical of such stomachs. Normal stomachs allow no such excursions.

Fig. 13. To demonstrate the great laxness in the structures which limit the excursions of the stomach, this same patient was placed on the left side and the tube was placed at the back. The whole stomach lies down against the left abdominal wall. Compare with the next picture, in which the patient is placed on the right side.

Fig. 14. This shows the lower pole of the stomach thrown way across the abdomen, nearly touching the right wall. This same laxness in those structures which normally prevent great excursion, may be demonstrated in connection with the colon. It allows stomach and colon to assume various positions under gravity or the influence of its contents. It is to be borne in mind in reading X-ray plates, and should make us very cautious in attaching a pathological significance to apparent kinks in the lumen of the bowel.

If we inquire into the early history of women of this congenital type we find that, in all well marked instances at least, we may trace the fundamental characteristics of this habitus to childhood. Inquiry will usually show that one or both parents, or even grandparents, had similar characteristics. There is undoubtedly a strong hereditary influence here. In Fig. 15 we have a number of such children (ages 4, 6, 9, 11) all showing the primary characteristics of this habitus — slenderness, lack of fat, and want of vigorous development. In these children we find the same muscular insufficiencies resulting in faulty attitude and flatfoot as found later in life. Note also the increased length of the limbs of these children. Such children are usually taller than others of corresponding age; at least, that has been the common observation. They are of course light of weight.

Fig. 16, by comparison, brings out clearly the fundamental characteristics of this habitus in children. They are both eleven years of age.

Children, however, show very little prolapse of the abdominal viscera. In a total of 100 female children between the ages of three and fourteen (examined by Butler and myself independently [1]) there were but six

[1] J. Am. M. Ass., 1912, lviii, 385.

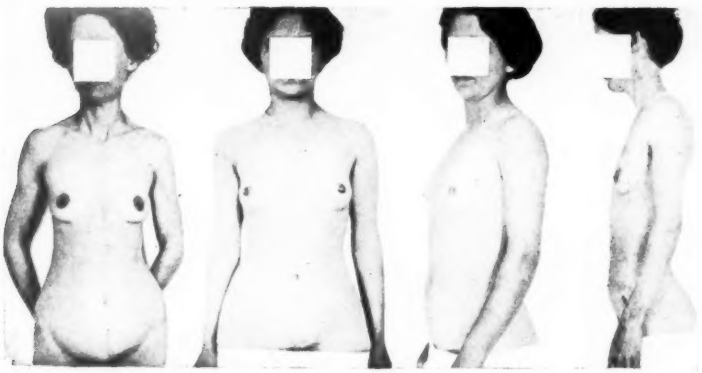


Fig. 9.

instances of palpable kidney and four of these were in children of twelve or over. In a series of 100 adults (all women), on the other hand, I found 43 had palpable kidneys. So we may say that, as far as the kidney is concerned, it is not demonstrably prolapsed in childhood, but becomes so later on. X-ray examination may reveal some sagging of the lower pole of the stomach and transverse colon but, as compared with the adult, it is slight. After the age of ten, and more especially in the years of puberty, the widening of the pelvis becomes more apparent, and with it there is a compensatory narrowing of the waist. With the well nourished woman this is but mildly indicated and inconsequential. With the thin, relaxed individual, on the other hand, this is pronounced. At this age we begin to find more frequently palpable kidneys and prolapse of the lower border of the stomach and colon.

In Fig. 17 we see a child of twelve years of typical frail build. Already the form is assuming the adult type; the chest is small, shallow and slightly collapsed. This girl had a palpable right kidney; there was no X-ray examination made.

Women are not born with displaced viscera, so that in one sense the terms congenital and

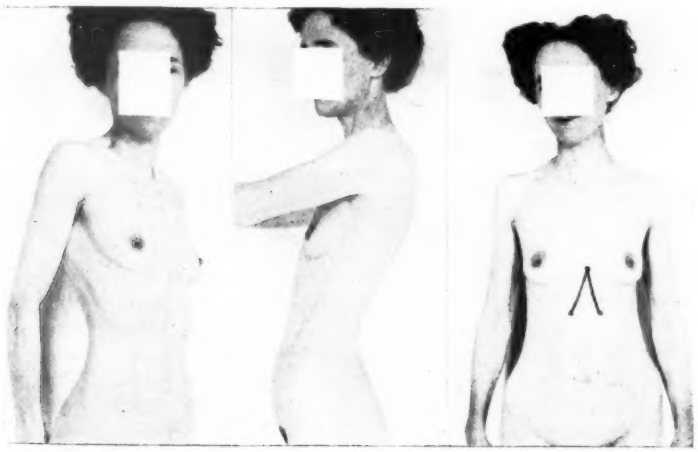


Fig. 10.

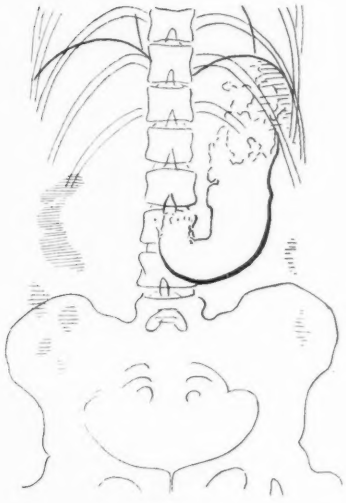


Fig. 11.

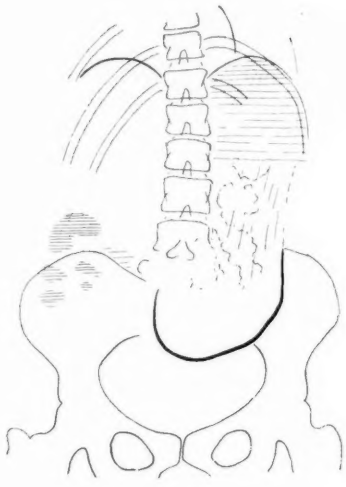


Fig. 12.

acquired, as usually used, are not correct. They should apply not to the prolapse itself, but to the habitus or physical make-up of the woman. The visceral prolapse itself is but slightly indicated in childhood, may be first well demonstrated during adolescence and reaches its maximum during adult life. The nutrition during childhood and adolescence influences the size and form of the chest and upper abdomen more than any other factor. Once established, this form does not materially change during later life. There is some widening of the waist line in late adult life, but the depth remains shallow if it has been so earlier. Since the nutrition of children may in most instances be bettered by proper hygiene, this fact contains a valuable hint in the prevention of enteroptosis. I would not be understood as saying that the abnormal form of the thorax causes the prolapse. The lessened amount of fat, the abnormal inner contour of the cavity itself, and the relaxation and weakness of the limiting structures within the abdomen may be regarded, I believe, as the most immediate *mechanical* causes of the prolapse.

To return to the adult. We can draw no sharp line of distinction between women of the two groups which we have discussed. If

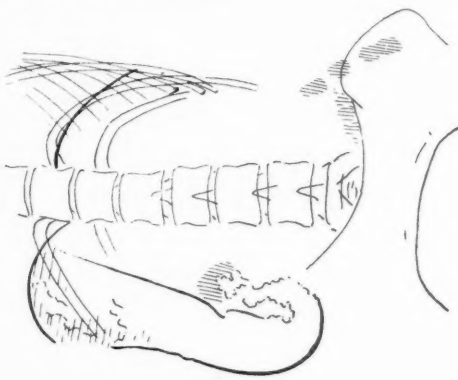


Fig. 13.

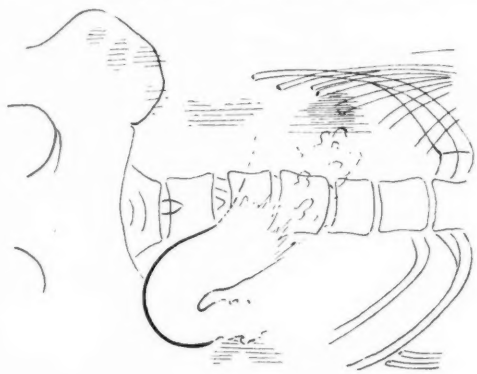


Fig. 14.

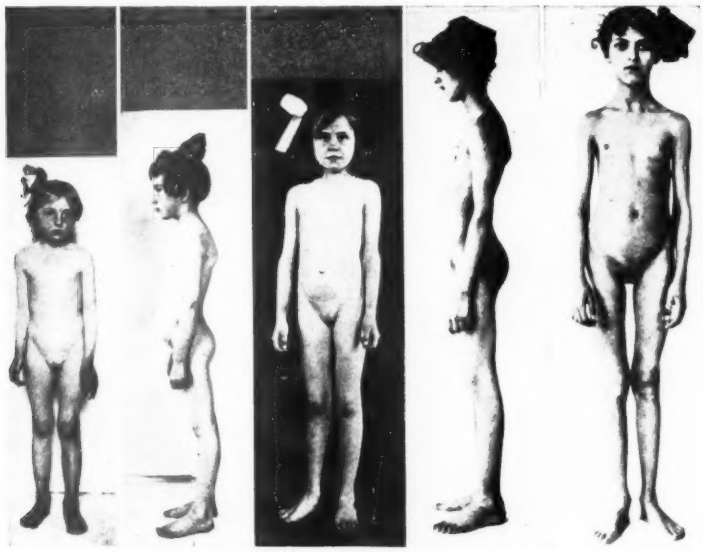


Fig. 15.

we examine a long series of women, we will find many of mixed type. But in the purer forms of each group we find so many points of difference as to make a distinction quite necessary. In women of the first or acquired group we are not dealing with long standing fundamental defects, although when the anomalies are outspoken the symptoms are quite as distressing. With women of the second or congenital group, on the other hand, we *are* dealing with such defects and, although she may often be brought into a state of good health, her innate lack of vitality will at the best limit her activities to a greater or lesser degree. We may not reasonably hope at this late period to endow her with an energy she has always lacked. Women of this second or congenital group, however, vary greatly, not only in the degree in which the anomalies exist but also in the kind and severity of the symptoms they present.

Those with the milder degree of enteroptosis and some in which the condition is fairly well pronounced but who are endowed with a stable nervous system (the best asset, I believe, they can possess), or whose lives are so well ordered that strain does not come frequently or great upon them, will have good health as we ordinarily know it or only have symptoms under strain. A surprising amount of good may be done these enteroptotic women of moderate type by proper hygiene and treatment, and even much worse cases may sometimes be improved. There are those, however, usually of marked degree, who seem doomed to perpetual invalidism and in whom the outlook for any therapeutic measures seems hopeless. An inventory must be taken of each case which presents itself. Her history in early life, the stability of her nervous system or the lack of it, her frailness of body, the amount of fat, the sufficiency of her muscular system or lack of it, the degree and description of the prolapse, and the condition of her digestion are all most important in this estimate.

This brings us to a consideration of the symptomatology. When not in health they present the symptoms so familiar to us all that I shall not repeat them, and we may divide them at once into several groups.

In the first group we may place the psychic and nervous disturbances (which are often the most distressing that she has).

Fig. 16.

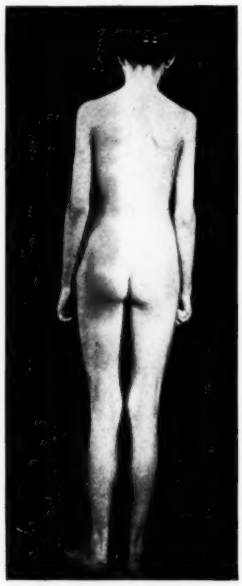


Fig. 17.

In the second, pain in the back, sides, feet, abdomen and other parts of the body, and which may, partly at least, be ascribed to muscular weakness and faulty attitude.

In the third, those symptoms produced by the prolapsed organs themselves; for example, the kidney, which may produce obstruction by kinking the ureter.

In the fourth, certain disturbances of function, principally those of menstruation, urination, and the digestive system.

The disturbances of the digestive system are by far the most important that we have to consider, for they are a great factor in making worse her general condition. The exact nature of these disturbances is not altogether clear, but is to-day a matter of speculation and opinion rather than exact knowledge. Many of these enteroptotic women, even when the prolapse is great, have good digestions and are free of symptoms; others, with care as to their diet and with rational living, are seldom disturbed; others suffer constantly from this source. More or less prolonged trouble with the digestive functions are very apt to follow exhaustive influences of all kinds, and so commonly has this been observed that it has given rise to the opinion that we are dealing here with a neurosis. In the prolapse of the viscera and in the anomalies associated with it, we have a gross mechanical defect, and it naturally follows that some should hold the opinion that this is the cause of the trouble in many if not all cases. The process of digestion is an intricate one, depending upon many factors for its normal state. Until all the factors and their individual importance can be better known no opinion in this matter will, I believe, reflect the exact or whole truth. Certain facts seem fairly well established. The stomach contents, procured by the test meal plan, show in a series of cases no constant chemical changes. Most enteroptotic women are constipated, even when they have no other digestive symptoms.

Fig. 18.

On investigation of those having digestive symptoms, we find a tardiness of the stomach and intestines to empty themselves—a stasis. In a considerable number of women we have examined, who presented the familiar stomach symptoms with constipation, we have found this to be a fact in all. This is best brought out by the bismuth meal and X-ray, and I show you here a typical case.

Fig. 18. This woman, with a well marked enteroptotic habit of the congenital type, presented herself with a long list of usual symptoms, combined with distress or uneasiness after eating, gas, marked constipation and occasional attacks of vomiting, lasting several days. A bismuth meal was given and, with the patient standing, X-ray plates obtained at intervals for the next nine hours, the last plate at the end of 20 hours. I am deeply indebted to Dr. Henry Hulst of Grand Rapids for his painstaking work in making these plates and for many suggestions.

Fig. 19. This first plate, taken at the end of two hours, shows a typical enteroptotic stomach containing the bismuth meal. A very small amount of bismuth has passed into the small intestine, the hepatic and splenic flexures are filled with gas and are here shown in nearly the normal position. It does not show the transverse colon. A capsule of bismuth and air remains in the upper end of the stomach.

Fig. 20. This second plate was taken at the end of two hours and a half. It shows more bismuth in the small intestine but the stomach still contains most of it.

Fig. 21. The third plate, taken at the end of three hours and a half, shows about the same thing. The stomach walls are folded on themselves above the bismuth, which is typical of the atony which such cases show.

Fig. 22. The fourth plate was taken at the end of four hours and 20 minutes. There is still bismuth in the stomach, which now normally should be empty. There is more bismuth in the small intestine.

Fig. 23. The fifth plate, taken at the end of five hours and a half, shows bismuth still in the stomach. The cæcum is beginning to fill up. There is still bismuth in the small intestine. Ordinarily the filling up of the cæcum goes hand in hand with the emptying of the stomach, so that when the stomach is empty, the cæcum is full. During the process, bismuth is found in the small intestine, but not normally in large amounts.

Fig. 24. This plate, taken at the end of six and a quarter hours, shows bismuth in the stomach, some in the cæcum, some in the small intestine, and heaped up more or less at the lower end of the ileum. Just what the normal condition is as regards the collection of bismuth at this point, is still a matter for discussion. As far as I know, no extended

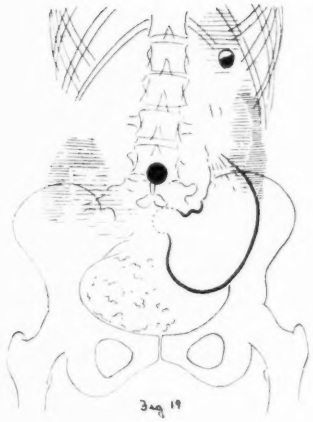


Fig. 19

Fig. 20

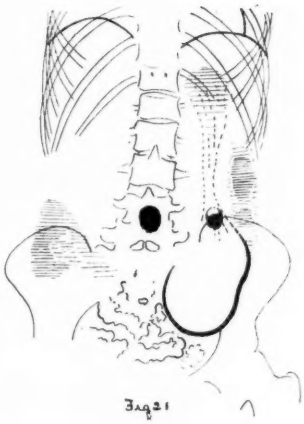


Fig. 21

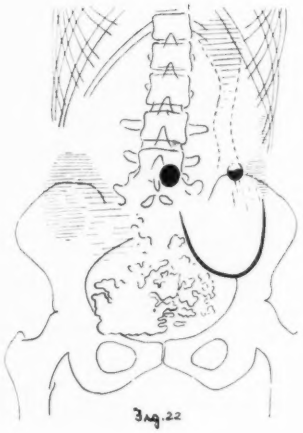


Fig. 22

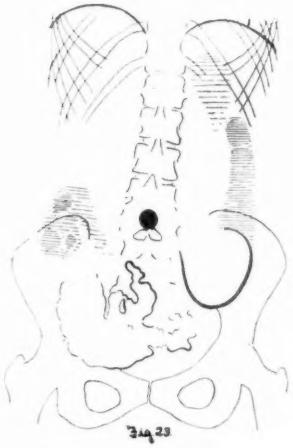


Fig. 23

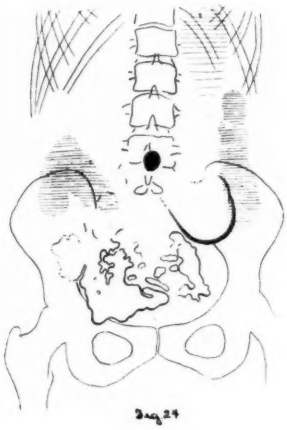


Fig. 24

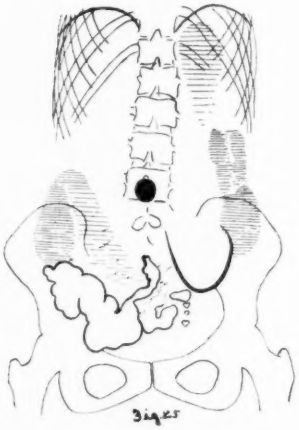


Fig. 25

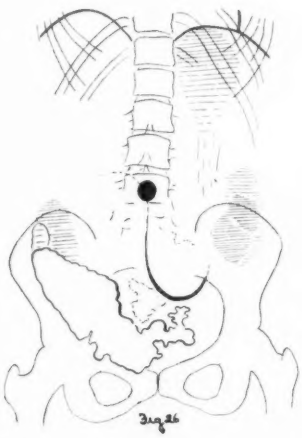


Fig. 26

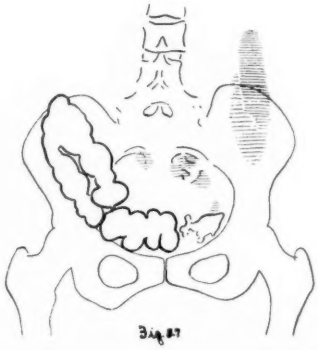


Fig. 27

series of observations have been made to determine it. Ordinarily, at least, one does not expect this to be pronounced.

Fig. 25. (7th plate). At the end of seven hours; the stomach is nearly empty. Bismuth is still seen in the small intestine, with the cæcum not yet filled.

Fig. 26. (8th plate). At the end of nine hours; the stomach is nearly empty. Bismuth is still seen in the small intestine, with the cæcum not yet filled.

Fig. 27. (9th plate). At the end of twenty hours; the cæcum and transverse colon to its middle are filled with the bismuth. Although the bowels have moved not much bismuth has passed. There is none in the stomach or small intestine. With the cæcum filled, there is seen some sagging of the hepatic flexure and the transverse colon presents the usual prolapse.

We have in this case, then, a delay in the passing of food products in the stomach, small intestine, and large bowel, decidedly abnormal at least in the stomach and presumably so in the small intestine and large bowel. We cannot, with any degree of certainty, diagnose any actual obstruction at any point in this case. It is a type frequently seen, and with cases that present more marked signs of constriction at various points in the alimentary canal, is a subject for present day discussion. The point I wish to make is that, as far as the X-ray examination goes, one cannot be too certain that in many of these cases any actual obstruction exists. The delay seems all along the line and depends upon factors as yet not clearly demonstrated.

I have purposely in this paper considered principally the anomalies of structure which are outside of the abdomen, and which I believe fundamentally to be at fault in the prolapse. That local defects in support exist, which allow the organs to assume a lower position in the abdomen, is apparent; that these defects are not the same in each individual case is demonstrated by the fact that the kidneys, stomach and colon do not prolapse often in parallel degree. It may be the kidneys, it may be the lower pole of the stomach and transverse colon, it may be the cæcum or hepatic flexure or even the splenic flexure, although more stable, which shows more than its share of prolapse.

That in the prolapse or in its irregularity, that in adhesions produced by inflammatory conditions, the result of infection or operation, there may be conditions produced which mechanically interfere with the passing of the food products, would seem reasonable, and that they do has been the opinion of many competent observers. They are questions which I shall leave to others on the program, whose clinical experience in this work has been greater than my own. My part in the symposium has been to speak of the individual herself and to emphasize the importance of not losing sight of fundamental matters in a nearer study of the viscera themselves.

HOW CAN THE SURGEON IN CIVIL LIFE BEST SERVE HIS COUNTRY IN TIME OF WAR?[1]

By CHARLES F. STOKES, A. M., M. D., D. Sc., LL. D., Washington, D. C.
Surgeon General, United States Navy

WHEN international complications assume menacing proportions and patriotism banishes class, party and sectional strife, thrilling the manhood of the nation with an overwhelming desire to stand by the colors, each untrained individual asks himself how and where he can serve to best advantage. In these hours of national stress the badly balanced are prone to indulge in hysteric utterances and acts that merely defeat the well-meaning aims that prompt these outbreaks.

Military preparedness demands of the navy — for which alone I am qualified to speak — an ability to strike a mighty and telling blow at the very outset, or to resist a vicious assault in the early days or, perhaps, hours of an international strife. It is plain to be seen that an effective navy should be on a war footing at all times. Ships can not be built nor can the personnel be properly trained in its very special activities after the outbreak of hostilities. The medical department is the only branch of the service that is not fully equipped, in time of peace, for its responsibilities in time of war. This apparent unpreparedness will not be safe until the Naval Medical Reserve Corps is fully recruited and properly instructed in the very important humanitarian activities that will be required of it. In the early days of war it is the surgeons, with their assistant personnel and equipment, that are most imperatively needed. The physicians play their part later on.

When it is fully realized that a vicious blow may be struck at the outbreak of hostilities, and that the naval battle of the future will not, in all probability, last over twenty minutes, and, further, that we may have twenty-five per cent of casualties, then it will be seen that there may be anywhere from ten to thirty thousand wounded on our hands, accumulated in twenty minutes, a situation unparalleled elsewhere. No army or navy has yet been properly prepared in the medical department for its responsibilities in time of war. It is to you patriotic surgeons that we turn in time of national stress to succor the wounded and to save your country from justifying the charge of apathy and indifference to its grave humanitarian responsibilities. The personnel of the regular establishment will be stationed almost to a man on the fighting ships, there engaged in purely military duties.

Before outlining in detail the field of work of the surgeons enrolled in the Medical Reserve Corps, let us consider for a moment the character of the wounds of naval warfare. Our new 14-inch guns have an effective range of about fourteen miles, and we now fire upon moving targets at a distance of nine and even ten miles in ordinary battle practice; the accuracy and rapidity of fire are amazing. Each of these monster rifles hurls a projectile weighing 1,400 pounds (two thirds of a ton of metal) at a velocity of 2,900 foot-seconds (about half a mile a second), and develops a muzzle energy of 66,000 foot-tons. The powder charge for the 14-inch piece weighs between 350 and 400 pounds, and each monster shell carries, as well, a large bursting charge of high explosive, so that at the moment of impact its destructive effects may be as far reaching as possible. The propelling and bursting charges of powder are made up of nitroglycerine, gun cotton, nitrocellulose, and a deterrent, yielding largely, as products of combustion, CO and NO_2, both dangerously poisonous gases, which have further complicated conditions aboard ship.

From the foregoing it will be apparent that in battle we shall have powder gases, not only from our own batteries, but from the explosions of shells hurled at us. Probably all the wounded will be more or less poisoned either by powder gas or smoke, a grave

[1] Read before the American Surgical Association, May, 1913, Washington, D. C.

menace to life, and a serious, complicating handicap to military effectiveness. That the seriousness of the menace from smoke is fully appreciated is apparent from the fact that the smokestacks of the new battleships carry thirteen inches of armor. A stack perforated low down or between decks might drive everybody out of the fire room, or asphyxiate all serving there.

From the composition of powder gas it is evident that we shall have two types of poisoning, one resembling illuminating gas poisoning, the other irritative in its effects. Both may vary in degree. In the one group, in mild cases, we find dilatation of the pupils, impaired vision, a fall in blood pressure, a rapid heart action, and possibly some mental confusion. A larger dosage of powder gas may lead to unconsciousness and death. As the complicated structural peculiarities of our battleships necessitate the employment of artificial ventilation, it is evident that should we run our ventilating systems during battle the best ventilated space at once becomes the most dangerous from powder gas contamination. After the battle of the Sea of Japan, Russo-Japanese War, on board a ship that had run its ventilating system during the fight, every person in one compartment was either dead or unconscious. It is probable that the undue proportion of prostration attending shell wounds, formerly attributed to shock, is really due, in part at least, to gas poisoning, and not to injury alone.

Shells are masses of steel with conical tips containing a detonating mechanism which, on impact, ignites a bursting charge, thus disrupting the shell into scores of fragments which shower a conical-shaped area from this point onward by reason of the momentum of the mass. Objects hit by oncoming shells are often set in motion, thus becoming secondary missiles. The shell fragments vary in size, with edges generally rough and jagged, are of relatively low velocity and usually so hot as to sear the tissues. The battery of a single ship may throw ten or more tons of metal per minute against the side of another; the accuracy of fire these days justifies the belief that the percentage of misses will be small.

To offset this offensive development, the vitals of battleships are placed behind heavy armor, and all objects that can be dispensed with, which are likely to explode shells or become secondary missiles, have disappeared. The so-called basket masts of the American navy aim to withstand shell fire without falling and without exploding shells.

From the nature of the projectiles thus briefly described, the seriousness of the wounds of naval warfare is evident. Whole limbs may be torn off, disemboweling may take place, or the entire body be peppered with small fragments. As the velocity of the fragments is relatively low, lodgment is common, and impact against bone frequently causes splintering. Practically all shell wounds are infected by reason of their extent, character and contaminating surroundings, and they are usually seared as well. Burns from exploding shells and fire, and scalds from damaged steam pipes add to the horrors of the situation. A detailed consideration of these injuries is beyond the scope of this paper. Shell wounds involving bones and the nervous and vascular systems teem with interest. The frequency of traumatic aneurisms will be appreciated when it is known that in one hospital a Japanese surgeon operated upon one hundred and ten cases. Head injuries are varied and complicated. The number of deaths from drowning equal those from gun fire.

In time of war the personnel of the medical department of a battleship carrying a thousand men would, in all probability, be three surgeons and from seven to ten hospital corpsmen, with possibly an additional detail of untrained men who have no other battle assignments. The duties of these individuals will be to keep as many men at their fighting stations as possible. Any attempt to undertake operative treatment or to remove the wounded to a dressing station is out of the question during action. The wounded will have to lie where they fall.

If the casualties reached thirty per cent we should have some three hundred thirty killed and wounded lying about the decks of a single ship. The medical department of the ship

could not possibly cope with this situation unless it received assistance from outside. The breakdown would lead to cruel and unnecessary suffering, and might assume the proportions of a national disgrace.

The assistance from without, just alluded to, must come from properly qualified surgeons in civil life who have previously been enrolled in the Medical Reserve Corps. The activities of the surgeon in civil life are purely humanitarian: he is a citizen of great value to his community. If, through patriotism, he offers the government his professional skill in time of national stress, it is perfectly proper that his life should be safeguarded by service under the Red Cross, in order that he may be reasonably sure to be returned to his community and resume his former activities. Under these conditions the surgeon in civil life — the enrolled Medical Reserve Corps officer — could render most valuable service to his flag. He would be out of place on the fighting ships by reason of his lack of military training.

I have devised a battle plan which will humanely and efficiently deal with the complicated problem of caring for the rapid accumulation of thousands of wounded. In describing this scheme in a paper of this sort it is deemed best to omit military and nautical details.

It is planned to charter large merchant steamers for service during hostilities, and to so remodel them that each will be capable of caring for about 1,000 wounded. Each one of these ships will be commissioned under the Red Cross, and thus neutralized, and will be assigned to a battleship division of the fleet. A division of the fleet, on a war footing, consists of four ships. The hospital space on each medical transport will be split up into four parts, each part being allotted to a ship of the division. The officers of the Medical Reserve Corps with their assistants, or hospital corpsmen, will be assigned to the medical transports under the leadership of a few officers of the regular service. They will there be arranged in four groups, each group being assigned to the care of a particular battleship and its hospital space on the medical transport. During a lull in battle, or after the action is over, the younger reserve corps officers, with their assistants and a specially prepared paraphernalia for effecting rapid occlusive and immobilizing dressings, will be put on board their previously assigned battleships, there to care for the wounded on the firing line.

The senior reserve corps officers remain behind to prepare for the reception of the wounded on the medical transports, and afterward to act as consultants or operators, as the case may be. Each reserve corps officer who boards a battleship should have with him at least two assistants, and an anæsthetist and a recorder, as well as the equipment alluded to. The flow of wounded will be continuous, and the fleet rapidly cleared, in case a renewal of battle is contemplated. It will be seen that the wounded will be handled in an orderly way and will be under the care of the surgeons who first treated them at the firing line until they are finally disposed of at the collecting station, or sanitary base. Each medical transport will be equipped with the necessary hospital appurtenances for operative procedures and other treatment, as well as for diagnosis.

The plan under consideration provides for a large sanitary base, to which the wounded will be rapidly transported, each group of medical reserve corps officers going on shore with the wounded under its care. Accurate and most valuable data will, no doubt, be available at the close of hostilities.

It is often necessary to care for the enemy's wounded, which, if humanely accomplished, will tend to an early resumption of friendly relations.

It is believed that in time of war the navy will require fully 1,000 officers in the Medical Reserve Corps, and it is urgently requested that properly qualified physicians and surgeons give this matter their consideration. Each reserve corps officer will be asked to interest from eight to ten assistants who would be willing to serve with him in time of war. These hospital corpsmen might be recruited from among young physicians, operating assistants, hospital internes, students, or hospital orderlies. An operator

might thus take with him the operating team with which he is accustomed to work.

It will be too late properly to recruit and instruct the reserve corps after the outbreak of hostilities. It is planned to give instruction through correspondence, by literature, by assignment to the Naval Medical School, and by duty in the ships of the fleet for brief periods, if feasible.

REPORT OF INTERESTING BACTERIOLOGICAL FINDING IN A CASE OF PEMPHIGUS

Isolation of an Anaerobic Bacillus from the Vesicles and Treatment of the Disease by an Autogenous Vaccine. A Preliminary Report

By ERNEST SINGLETON HENDRY, A. B., M. D., Baltimore, Maryland
Assistant Resident Physician, Union Protestant Infirmary

FOR the past two months I have been studying a case of pemphigus in the hope of determining the etiological factors in this disease, so mysterious as to etiology and so discouraging as to treatment. Before going into the bacteriological investigation, it might be well to make a brief note of the clinical findings. The patient was a man 38 years of age, weighing 250 pounds, very nervous, weak, and unable to sleep on account of the extreme discomfort produced by the disease. There was a marked ulceration of the mucous membranes of the pharynx and larynx resulting from the vesicular eruption with increased salivary and mucous secretions. Over the chest were two large areas made up of blebs and ulcerated bases due to the confluence of ruptured vesicles. In the course of a week fresh blebs appeared scattered over the abdomen, and it was from these that our bacteriological investigations were made.

The method of procedure was as follows: The surface of the bleb was seared and the fluid from the vesicle aspirated. The cultures from this were made upon various media. The staphylococcus epidermidis albus was obtained from all of these blebs in pure culture on aerobic media. As this obviously was simply a contamination of the vesicular fluid by the normal bacteria of the skin, the possibility of finding an anaerobic micro-organism was considered, and cultures were made on human muscle under agar. The young separate blebs were selected for this purpose. The growth was extremely slow, one to three weeks elapsing before a small white area was detected on the muscle. On microscopic examination this proved to be a growth of a very short, small bacillus, in some cases appearing segmented and in pure culture. The hanging drop made immediately showed the same bacillus slightly motile with a tendency to occur in clumps. With this as control a positive agglutination was obtained with the patient's blood serum. From this pure culture, broth, milk, agar, blood serum agar, and serum glucose agar were inoculated, both aerobically and anaerobically, but so far no growth has been obtained. Transfers to new bits of human muscle proved successful, the growth occurring much more rapidly than on the primary culture. Now a macroscopic growth could be detected as early as forty-eight hours. Hanging drop from these showed the same organism, but with diminished motility. No growth was obtained on the non-inoculated bits of muscle treated anaerobically by the same method. In other words, the growth did not originate in the muscle itself. Specimens of muscle were obtained from different patients and various inoculations made from different blebs over a period of two weeks, with always the same result.

The presence of this micro-organism in the blebs and the fact that it agglutinated with the patient's serum suggested the possibility of this bacillus being the cause of pemphigus

and for that reason a vaccine was prepared. It is, of course, far too early now to report as to the possibility of preparing an antitoxin but the vaccine prepared by the ordinary method is now being given. Beginning with 50 million bacilli, the dose was gradually increased every twenty-four hours, until a maximum of 400 million was reached at the end of a week. This amount was then repeated every other day. The fact that the patient has shown gradual improvement after these vaccinations, while not at all a proof of their curative value, as the disease, of course, is peculiarly prone to show improvement at various stages during its course without any apparent reason, nevertheless is sufficient to warrant us in carrying out further and more extensive investigation along this line.

Following the technique as described above, it is interesting to note that the same organism has been grown from two other cases of pemphigus, from one of which a pure culture has just been obtained.

I wish to thank Dr. W. A. Fisher for suggesting the Noguchi method.

DECOMPRESSION IN CASE OF SEVERE INTRACRANIAL TENSION WITH FAILING CIRCULATION: AN EXPERIMENTAL STUDY

By CHARLES H. FRAZIER, M. D., and A. B. EISENBREY, M. D., Philadelphia

SINCE the early nineties the subject of intracranial tension has received the attention of many investigators. Their contributions to our knowledge of the physiological factors concerned in the causation of increased tension and of the symptoms which this condition itself produces, based on animal experimentation, have been suggestive in directing the surgical treatment of clinical cases. Trauma, tumor, abscess, hæmorrhage, hydrocephalus,— all, in varying degrees, may produce symptoms referable to increased intracranial tension. These symptoms are attributed to interference with the blood supply of the medulla, and the heightened blood pressure encountered in such states is regarded as a beneficent compensatory measure.

It is unnecessary to review the advances made and the successes that have been achieved in the surgery of the brain since practical application of the laboratory findings has been made. Indications for the operation of decompression have been found in fields that were regarded as purely medical, and the range of usefulness for surgical therapeutics has been widely extended. In like measure the fuller knowledge and appreciation of the physiological factors involved in any surgical attack upon the central nervous system has helped to surround such procedures with additional factors of safety.

In these investigations it has been our purpose to study decompression in relation to the intracranial disturbances following trauma, especially the lesions such as contusion, which are followed by a rapidly increasing intracranial tension.

The effect of decompression in cases showing symptoms of advanced compression, such as deep stupor, markedly high blood pressure, respiratory disturbances and vagus pulse, has been most variable, and in many cases most disappointing at the time of the operation. While the symptoms may not indicate a particularly severe grade of intracranial tension or yet have been of long duration, in spite of an extensive decompression, paralytic symptoms arise, the respiration and circulation fail.

It is a well-known clinical fact that a majority of the cases of serious cerebral contusion, such for example as attend basal fractures, recover spontaneously, even though they may have reached the stage of vagus disturbance or even of vasomotor disturbance. With the compensatory increase in blood pressure in these cases decompression

may relieve some of the subjective symptoms, such as headache, or may even so diminish the intracranial tension that the vagus and vasomotor disturbances may subside more rapidly; but the operation at this stage is clearly not a life-saving procedure, and therefore its performance as a routine is of very questionable propriety.

In the following experimental work our aim has been to study the effectiveness or the ineffectiveness of decompression in preventing a fatal termination in the more severe types of intracranial pressure or the types with fatal tendencies; that is to say the types which pass beyond the stage of compensation to the "Lähmungsstadium" (Kocher) with its failure of the respiratory and circulatory mechanism. It is in this group that operative intervention might be resorted to with propriety should it prove effective.

Because of the relatively limited time available for graphic registration of the physiological phenomena in individual experiments, it is evident that these symptoms must be brought about rapidly as compared with the gradual onset of similar conditions that is usual in clinical experience. A rapidly raised intracranial pressure with little or no time for readjustment or compensation constitutes a more severe and direct assault upon the vital centers than does an equal degree of pressure gradually produced.

Our experiments may be divided into two distinct groups. In the first group the increased pressure was produced by substances introduced between the cranium and the brain, and in the second by causative factors within the brain substance itself.

Twenty-three dogs and one Rhesus monkey were utilized in the experiments. In all cases the animals were under full ether anæsthesia administered by intratracheal insufflation. Undoubtedly this method of anæsthetization, affording as it does a very efficient artificial respiration, prevented a discouraging mortality early in many of the experiments, when a too rapidly raised pressure had caused a temporary respiratory failure, before compensation had occurred; the method was also invaluable when in the event of early respiratory failure without marked circulatory disturbance it was desired to maintain the given intracranial pressure until the effects of decompression could be studied. Graphic records of the blood pressure and respiratory movements were made. Where feasible the actual intracranial pressure or changes in the volume of the brain were recorded on the same drum.

"General compression" was produced according to the method described by Cushing, and our results, in so far as the physiological reactions produced are concerned, are in accord with his conclusions. A small metal cannula was firmly screwed into a trephine hole in the parietal region after having first opened the dura. The cannula was connected by a T-tube with a mercury manometer for graphic registration of the pressure of the solution, which represented also the intracranial pressure. The other arm of the T-tube was connected with a supply bottle containing normal saline solution that could be raised or lowered by cord and pulley attached to the ceiling.

Intracranial pressure so produced is uniformly distributed over all parts of the brain including the medulla. The effects upon respiration and circulation should be proportional to the degree of compression of the vessels and to the resulting anæmia of the vital centers in the medulla. In five experiments it was found that the increase of pressure necessary to call forth a response of the vasomotor center resulting in a slight rise of blood pressure averaged 10 to 15 mm. of mercury. This may be explained on the basis of a vasomotor response due in part to an anæmia of the cortex owing in all probability to the easy compressibility of the small superficial vessels supplying that region, and in part to sensory stimuli from the dura. When the pressure was raised gradually, but steadily, but little change in the circulation except a slight rise in the blood pressure level was noted until the intracranial pressure approximated that of the general blood pressure or in the average case, 100 mm. of mercury. Then the response was a rise in blood pressure which constantly tended, in case of a further rise in intracranial pressure, to maintain a level slightly above that of the intracranial pressure. If, however, the in-

tracranial pressure was rapidly raised to a point considerably above that of the blood-pressure level, vasomotor compensation did not come into play and circulatory failure rapidly supervened. This failure was ushered in by slowing of the heart through vagus inhibition, then by an abrupt fall of blood pressure. The character of this circulatory failure indicates that in addition to the marked vagus effect there is undoubtedly a simultaneous paralysis of the vasomotor center.

In these experiments before the maximum circulatory effects had been attained the respiratory center gave evidence of involvement. Slowing and deepening of the respiration was noted when the intracranial pressure was still considerably below the level necessary to produce serious changes in the circulation. As the pressure was increased the respiration became shallow and still slower, and ceased just before the circulatory failure began. In all cases the respiration was the first to fail, and although asphyxia was prevented by intratracheal insufflation, it is possible that the absence of the "respiratory pump" action may have been an added factor in promoting the rapidity of the fall in blood pressure. It was found extremely difficult to produce and maintain a pressure that would cause the marked respiratory or circulatory symptoms desired without a complete failure of both. In fact we were unable to produce a period of failing circulation of sufficient length to permit the carrying out of surgical procedures. The actual failure of circulation was always of rapid onset, and in order to try to save the animal, it was necessary rapidly to reduce the intracranial pressure by lowering the supply bottle. The most striking fact from a practical standpoint was the frequency of failure to save the animal even by this most effective means of reducing the intracranial pressure, when once the failure of circulation had begun (Fig. 1).

With a pressure sufficient to cause the maximum severity of symptoms, just short of actual circulatory failure, with absence of, or severe disturbance of, respiration, with high blood pressure, and with vagus pulse, decompression of the opposite temporo-parietal region was done, and the usual condition of a tense and bulging dura was found. With the removal of an area of bone even relatively more extensive than the area removed in similar clinical cases, the *intracranial pressure as shown by the manometer was but very slightly decreased, and the symptoms showed practically no improvement.* The same negative results were obtained when the procedure was carried out in the sub-occipital region where, though a less extensive decompression is possible, the pressure over the medulla was more directly relieved. The further opening of the dura added but little to this except for slight improvement in respiratory function and lessening of vagus action. That portion of the brain which bulges through the opening rapidly increased in size and, according to the work of Cannon (*Am. J. Phys.*, 1901, vi, 91), this must result in severe injury to the brain tissue itself, as pressure on the edges of the dura and bone causes interference with its blood supply, and œdema results. In some of our cases the force of protrusion was sufficient to disintegrate the brain tissue.

Local compression. Increased intracranial pressure due to local compression was produced by the introduction of well-circumscribed masses such as small dilatable rubber bags between the dura and the brain in the parietal or in the occipital region. In our work a "tumor" of generally globular form and of a volume of 1 or 2 cc. caused a small but definite rise in blood pressure, which was of short duration. The transient nature and the smallness of the rise is probably to be accounted for by the fact that displacement of the cerebrospinal fluid and the compressibility of the larger venous channels permitted a readjustment of the impaired circulation in the localized area of the cortex from which the stimulation of the vasomotor center arose. When the volume of the tumor was increased to about 6 cc., the respiration became involved, and at approximately 8 cc. the circulatory symptoms became manifest (Fig. 2). These volumes are relative only and varied with the cranial capacity of the animal used. When the size of the tumor

was carefully adjusted so as to produce just a beginning involvement of respiration and circulation, relief was readily afforded by a free and rapid decompression of the opposite parietal region, in some cases even without opening the dura. In general it was evident that the power of accommodation and readjustment possible so far as the vital centers are concerned, in the presence of a relatively large but circumscribed artificial tumor, is rather great when such a tumor is situated over the cerebral cortex. If, however, such a tumor is placed in the occipital region the fatal tendencies are naturally much greater and of more rapid onset since the pressure exerted by even a small tumor is more directly transmitted to the underlying medullary centers. In these cases cerebral decompression in the parietal region was largely inefficient. It may be said for "local compression" as for "general compression" that when respiratory failure has occurred and the blood pressure has begun to fall, neither decompression nor the collapse of the tumor serves to prevent a fatal termination. The regulatory mechanism of the vasomotor system is not called into play with the uniformity that it shows under general compression; and the onset of respiratory and circulatory disturbances is more sudden, and these disturbances are of a more severe type.

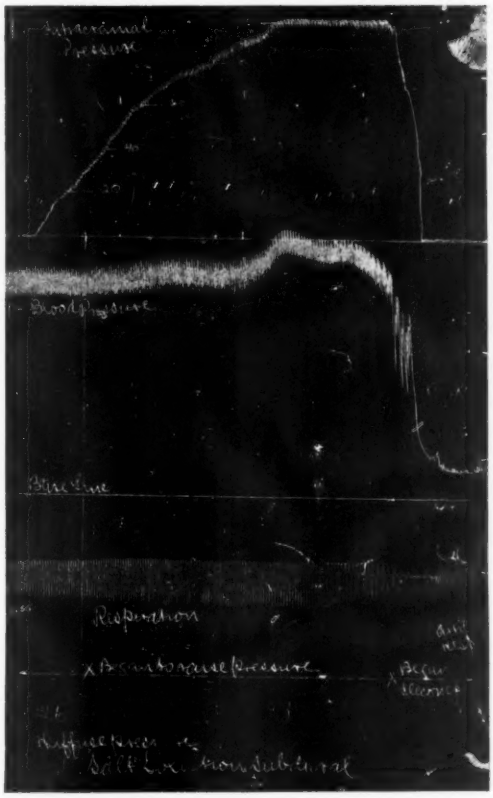


FIG. 1

Contusion. In our attempts to produce increased intracranial pressure through causes lying within the brain itself, the methods described by Cannon were employed. He demonstrated in cats that, following contusion of the brain substance by blows transmitted through the skull, an œdema of the brain tissue is produced. This œdema is the result of deficient circulation due to thrombosis of the small terminal arteries supplying the cortex, and is, he believes, the cause of the secondary pressure symptoms common in cases of head injury. He showed also that there is a marked tendency of this œdema to progress. As a given area takes up fluid and swells, the circulation of the adjacent tissue is impaired. This in turn becomes œdematous, and the process continues until the intracranial pressure so generated is sufficient to obstruct the circulation of the vital centers, and death ensues.

The period required for the development of an œdema sufficient to affect the vital centers is evidently great, for in the time available for each experiment, up to five hours, we were compelled to deal with the more immediate effects of the contusion. These effects in so far as the blood pressure and respiratory findings were concerned agreed with those described by Cannon (Fig. 3).

The rise of blood pressure directly following the injury was of short duration. In one case a slight but persistent rise unaccompanied by respiratory disturbances was relieved by trephining at the site of the contusion and the removal of a subdural accumulation of blood. Evidently the rise was caused by

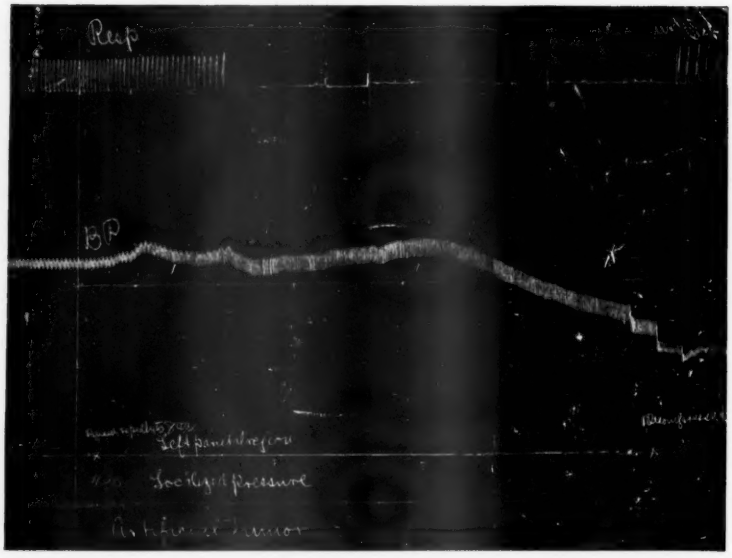


FIG. 2

the local anæmia of the cortex due to the pressure of this clot. In none of the experiments, during the relatively short period (four or five hours) over which they ran, did any typical pressure symptoms develop. Although there were disturbances of the respiration amounting in some instances to a transient paralysis of that function immediately following the injury, none of the respiratory symptoms typical of increased pressure were produced.

Since it is altogether probable that a great number of cases of traumatic injury of the skull presenting pressure symptoms of severe grade must owe the increase of intracranial pressure to an œdema of the brain tissue, it is a matter of regret that its experimental production has not been accomplished to a degree to make it available for study in this connection. The brains of these animals showed evidence of severe contusion of the area over which the blows were delivered, but in no case even five hours after the trauma was there a tense and bulging dura found on opening the skull.

Embolism. Following a suggestion received in a personal communication from Cannon, attempts were made to produce cerebral œdema by causing embolism of the smaller vessels of the cortex through the injection of suspensions of lycopodium spores into the carotid arteries. A quite opaque suspension was made in normal saline solution and this was injected through an hypodermic needle into the common carotid artery close to its bifurcation. Usually 2.5 cc. of the suspension was injected into each carotid. The effects were immediate and most striking both on respiration and circulation, but they could not be ascribed to an increased intracranial pressure (Fig. 4). There could be no doubt but that the blood supply of the centers concerned had been obstructed by the seeds. Decompression, as was to be expected, exerted no beneficial effects.

Conclusions. The physiological phenomenon, repeatedly observed throughout these experiments, was the failure to prevent a fatal issue once the circulation, as indicated by the blood pressure, began to fail. No matter how the artificially increased intracranial tension was brought about the results were the same. Cases of severe cerebral contusion may be divided for convenience'

FIG. 3.

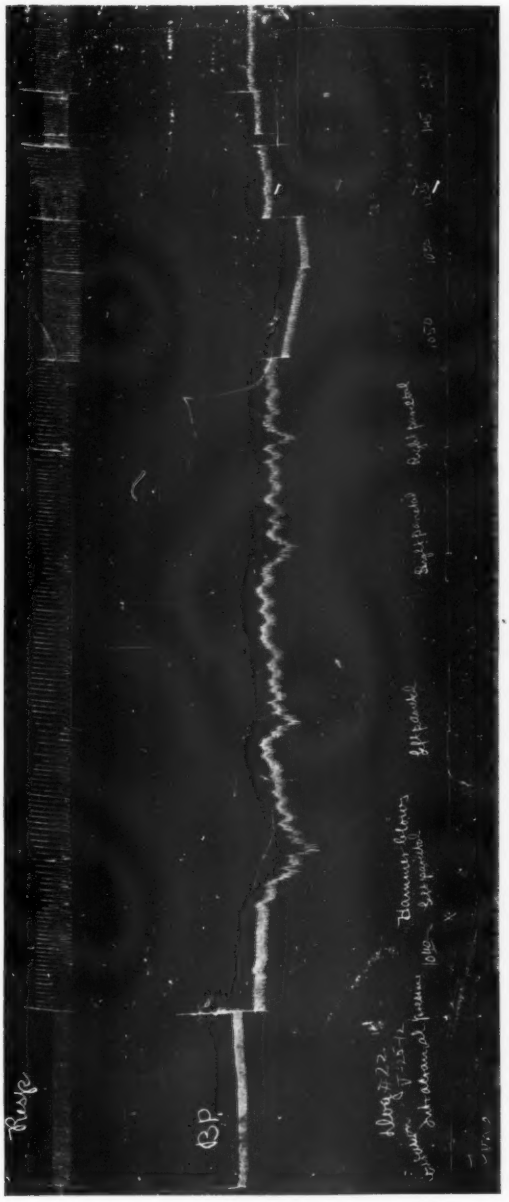
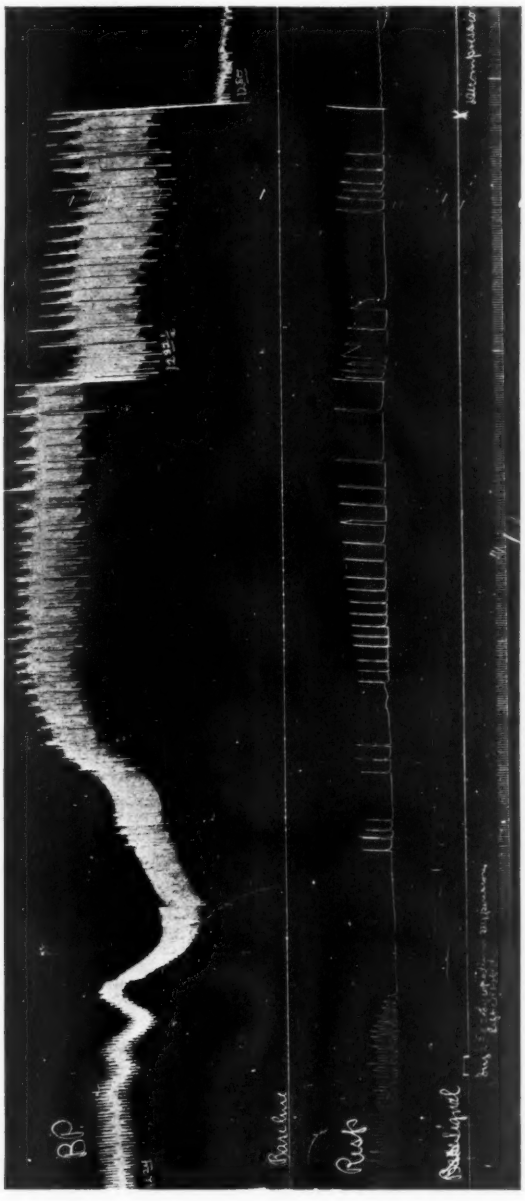


FIG. 4.



sake (1) into those in which the process whatever it may be becomes arrested at a point at which full compensation is provided for the increased intracranial tension (as we have reason to believe by stimulation of the vasomotor center, and (2) those in which the process advances to a point at which the process continues to be operative until there is a breakdown of the vasomotor mechanism. Clinical experience has taught us that the first group spontaneously recover, and the second group quite as regularly succumb. Decompression of the brain in our experimental work had absolutely no deterring influence upon the ill effects of intracranial tension in the serious cases. If the problem were altogether one of tension, of encroachment upon the intracranial space and pressure upon the medullary centers, we have been led to believe that the removal of an area of the bone, as in decompression, will give immediate and very decided relief to the symptoms, but in our experiments the intracranial pressure as measured by the manometer was but very slightly decreased.

To repeat, once the circulation and respiration began to fail (Fig. 1), the vasomotor or respiratory center was unable to recover its tone and function, whether or no decompression was practiced. This laboratory observation explains the clinical failures which follow decompression, in cases with circulatory and respiratory failure following cerebral contusion, and is, we believe, an observation sufficiently accurate and significant to warrant our looking with disfavor upon decompression measures as a means of saving life in the cases of intracranial trauma under consideration.

If it were a problem only of impairment of circulation the result of increased intracranial tension and the improvement of the circulation in the medullary centers by the relief of pressure, one would expect that the establishment of a decompression opening in the suboccipital region immediately over the medulla would be more beneficial than a temporal decompression. But here again our experiments showed that suboccipital decompression was of no more value than a temporal decompression. Were this not proved by experimental observation, one would have been inclined in actual practice to regard suboccipital rather than temporal decompression as the more rational procedure.

No doubt clinically there is a high degree of intracranial tension; so high that the brain bulges through the opening in a shocking fashion, but it must be remembered that in all probability there is a similar degree of tension in every other structure of the brain, the medulla included, that the tension is due to an intense œdema, and that the establishment of an opening in the skull in the temporal region will have little or no effect upon the structure in the posterior fossa.

The inability to arrest the advancing œdema by any surgical procedure, coupled with the inability of the respiratory and circulatory centers to recover once the "Lähmungsstadium" has been reached, accounts for our failure to arrest or relieve the fatal tendencies of cerebral contusion by decompression, and at once removes any sound argument in favor of its performance.

AN EXPERIMENTAL STUDY OF UNILATERAL HÆMATURIA OF THE SO-CALLED ESSENTIAL TYPE[1]

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AND
WM. DeB. MacNIDER, M. D., Chapel Hill, North Carolina
Professor of Pharmacology of University of North Carolina

UNTIL a few years ago we held firmly to the tenets of our medical training, that hæmaturia from one kidney must be due to a new growth, stone, or tuberculosis. All the standard text-books of our student days taught that symptomless hæmaturia was angioneurotic in origin, and not one of them told us that the disease could be unilateral.

Our attention was first called to this condition by the following case:

Case 1. J. C., male, aged 45. Complaining of several attacks of right-sided renal colic and constant bloody urine. Family and past history negative. Physical examination revealed a fat, well-nourished man with absence of any cardiovascular lesions. Both kidneys were in their normal position; neither could be palpated on deep inspiration, and there was no tenderness on deep pressure in the loins. Cystoscopic examination showed a normal bladder, with blood coming from the right ureter and clear urine from the left. Ureteral catheterization showed blood, hyaline and granular casts from the right kidney, and normal urine from the left. Bacteriological examination of right specimen negative; X-ray showed enlarged right kidney and an indistinct shadow which we thought to be a stone.

Operation revealed an enlarged dark kidney, lobulated with adherent capsule. Complete section from pole to pole and down to the pelvis showed nothing except a congested cortex. The kidney was closed by mattress sutures, and from that day to the present time the patient has been free from colic and hæmaturia.

In studying the literature, we find numerous surgeons have had many such experiences, and in searching for an explanation various reasons have been assigned as the cause of this most unusual condition. While Rayer, in 1841, mentions unilateral hæmaturia, Socoloff in 1874[2] first reported a definite case, which he ascribed to an interference with the nerve impulses to the renal vessels—a condition which we now call angioneurotic œdema. Following this report, Sabatier,[3] Legueu,[4] and Broca[5] record cases which they ascribe to this same angioneurotic cause. Just about this time Senator[6] came out with a powerful monograph refuting the cause of angioneurosis and declaring local hæmophilia to be the exciting factor in these cases of unilateral renal bleeding. Aiken (quoted by W. E. Lower) follows Senator and reports seven cases of hæmophilia of the kidney, these cases representing three different generations of the same family. Guthrie[7] reports twelve cases of renal hæmophilia in the same family, the inheritance being entirely through the females. Atlee[8] reports three most unusual types of renal hæmophilia. The arguments against the theory are that hæmophilia is not a local process and these cases do not bleed from elsewhere; the condition does not follow injury and does not occur in families.

In 1897 Klemperer[9] created quite a stir among the internists by expressing his belief that the so-called essential or idiopathic hæmaturia is due to a paralysis of the vasoconstrictors with dilatation of the renal vessels and a resulting diapedesis. The condition he called angioneurotic œdema of the kidney, and from this paper the various text-book writers received the impetus for the teachings so often found therein.

The first article of dependable worth came from de Keersmächer,[10] when he first called attention to inflammation in one or another

[2] Berl. klin. Wchnschr., 1874, ii, 233.
[3] Rev. de Chir., 1889, p. 62.
[4] Ann. des Mal. des Org. Gen.-Urinar, 1891, p. 564.
[5] Gaz. Hebdom., 1894, No. 50.
[6] Berl. klin. Wchnschr., 1891, No. 1.
[7] Lancet, Lond., 1902, i, 1243.
[8] St. Bartholomew's Hosp. J., Dec., 1901.
[9] Deutsche. med. Wchnschr., 1897, Nos. 9 and 10.
[10] Ann. des Mal. des Org. Gen.-Urinar, 1897, Feb.

[1] Read before the Southern Surgical and Gynecological Association, December 19, 1912.

form as the exciting cause of idiopathic hæmaturia and showed the definite entity of unilateral nephritis. Pousson[1] reports cases of symptomless hæmaturia in which he found inflammatory alterations in the glomerulus. Hofbauer[2] also describes changes in the glomerulus. Laurent[3] and Israel[4] report cases of hyaline degeneration of the blood vessels while Rovsing of Copenhagen[5] found circulatory disturbances and thickening of the capsule. Albrecht and Lowenhart (quoted by Albarran) describe interstitial lesions in the pyramids.

The most valuable contribution to nephritis as the cause of essential hæmaturia came from Kretschmer[6] in which he collected 129 cases from the literature, 52 of which showed definite microscopic changes of nephritis. He principally found lesions of the glomeruli and desquamation of the epithelium in the convoluted tubules. Lower[7] reports two cases with nephrectomy in which the microscope showed nephritis. Casper[8] writes that nephritis is at the bottom of all these cases and if delicate tests for a sufficiently long time are carried out, albumen and casts will be found; failing, the case may still be one of *nephrosis circumscripia*. In this connection Schuller[9] and Israel[10] both say nephritis can exist without casts or albumen. Rigdon[11] reports two positive cases of nephritis as the exciting cause and argues that hæmaturia is the initial symptom of chronic nephritis. Schenck[12] reports two cases showing nephritis. Kotzenbergs[13] reports twelve cases which he believes due to a bilateral toxic nephritis. He thinks the hæmorrhage in these cases is the initial symptom of the nephritis, but at the time of observation only one kidney showing blood. This is most untenable, for very rarely does the other kidney ever bleed.

[1] Ass. Fran. d'Urol., 1900, p. 100.
[2] Mitt. aus dem Grenzgeb. der Med. u. Chir., bd. v, s. 423.
[3] Deutsche med. Wchnschr., 1901, No. 13, s. 193.
[4] Klin. der Nier., Berlin, 1901.
[5] Brit. M. J., 1898, ii, p. 1547.
[6] Ztschr. f. Urol., 1907, i, p. 490.
[7] Ohio St. M. J., Oct., 1910.
[8] Arch. f. klin. Chir., ixxx.
[9] Wien. klin. Wchnschr., 1904, xvi, 477.
[10] Klin. der Nier., Berlin, 1901.
[11] Calif. St. J. M., Nov., 1910.
[12] Surg., Gynec. & Obst., July, 1911.
[13] Ztschr. f. Urol., 1908, 125.

Along with these cases, E. H. Richardson in a personal communication to me records a case of bilateral hæmaturia relieved by a right-sided nephrotomy from which an excised piece of kidney showed parenchymatous nephritis.

Turning aside from the consideration of nephritis, we find Fenwick[14] describing angioma of the papillæ as the cause of the so-called essential hæmaturias and reporting six such cases. To support Fenwick we find McGowan (quoted by Lower), Pilcher,[15] Cabot,[16] Whitney,[17] reporting similar cases and Hale White[18] records five cases of angioma of the papillæ seen in Guy's Hospital. Rovsing (Ibid) and Israel (Ibid) both admit the presence of nephritis as a cause of symptomless hæmaturia, but argue that usually there must be some more definite cause for the bleeding and lay stress on tuberculosis, new growths and ascending infection. In this connection, Albarran,[19] Kapsammer (quoted by Albarran) and Davidsohn (quoted by Albarran) report cases showing minute *foci* of tuberculosis. Albarran says the least lesion of nephritis is capable of determining the vascular or angioneurotic modification capable of leading to bleeding. Rovsing (Ibid) says local infection plays a more important part than toxins in the production of the nephritis and Chute[20] argues that the nephritis may be toxic or infectious. He further says the infectious type may show blood and pus or an absence of pus with inflammatory changes remaining in the kidney after the infectious agent has disappeared. Billings (quoted by Lower) reports a few infectious cases due to colon bacillus which were treated successfully with autogenous vaccines. Squier[21] reports a case relieved by nephropexy, but a careful study of his report would force the burden of cause of cure upon the nephrotomy, the evident cause of blood and pus being an unilateral nephritis of infectious origin.

[14] Brit. M. J., 1900, No. 1, p. 248.
[15] Ann. Surg., Phila., May, 1909.
[16] Am. J. M. Sc., Jan., 1909.
[17] Boston M. & S. J., 1908, Vol. clviii, p. 797.
[18] Quarterly J. M., Lond., iv, No. 16, 1911.
[19] Ass. Fran. d'Urol., 1900, p. 104.
[20] Am. J. Urol., Vol. iii., 1907.
[21] J. Am. M. Ass., Dec. 2, 1911.

Since our first case we have personally observed four other cases in private work, as follows:

CASE 2. Male. M. L. J. Age 40. Farmer, giving a history of persistent bloody urine for past year with dull pain in right loin. X-ray and physical examinations negative. Cystoscope showed a normal bladder with blood in abundance from right ureter. Microscope disclosed hyaline and granular casts from the right specimen, with absence of bacteria, while the findings were negative in the left specimen. Operation upon the right kidney showed an organ normal in appearance and size. Bisection disclosed a narrow dark cortex, considerable congestion between the pyramids, with a few small clots in the pelvis. The kidney was closed with mattress sutures and after the fourth day the urine became clear. The patient gained rapidly in weight and has had no pain or hæmaturia since his operation. Three months after operation the urine showed no albumen but a few hyaline and granular casts.

CASE 3. Female. Mrs. M. W., multipara; age 35. Complaining of repeated attacks of mild renal colic with intermittent hæmaturia. At times the urine was very bloody. Past history very suspicious of gonorrhœa. X-ray negative. Cystoscope showed slight congestion of trigone with a prolapsed, blood-smeared right ureteral orifice. Remainder of bladder normal. Catheterization of ureters showed blood, with abundance of granular casts from right side, nothing in left specimen. Bacteriological examination negative. Operation disclosed a very large lobulated kidney with many adhesions, making delivery quite difficult. Nephrotomy showed several patches of scar tissue scattered throughout the parenchyma, but nothing else. The kidney was closed and during the convalescence the patient had a few attacks of mild pain due to the passage of clots. The urine cleared up before she left the hospital and there has since been no pain or hæmaturia.

CASE 4. Male. P. M. J., age 54. Complaining of profuse intermittent hæmaturia with absence of pain. Physical examination showed a pronounced anæmia with great loss of weight and strength. Palpation of the kidneys and X-ray examination revealed nothing. The cystoscope showed a blood-stained bladder with the hæmorrhage coming from the right ureter. Catheterized specimens showed blood, hyaline, granular and bloody casts from the right kidney, while the left specimen was negative. Bacteriological examination and tuberculin test were negative. Operation and bisection of the kidney showed nothing abnormal but congestion. Following the operation the urine became clear and has remained so to the present time. This patient made a very rapid gain in weight and has been actively at work since leaving the hospital.

CASE 5. Male. H. B., age 48. Farmer and alcoholic. Gives a history of periodic attacks of hæmaturia without pain or other symptoms. The usual examinations together with X-ray showed nothing, while the cystoscope revealed a normal bladder and normal ureteral orifices. Catheterized specimens disclosed an absence of blood from both sides, but albumen, hyaline and granular casts from the right kidney and normal urine from the left. Two subsequent ureteral examinations one month apart gave the same findings plus blood from the right side one time. Between these examinations the patient had several attacks of hæmaturia, but living ninety miles distant, I have never seen him during an attack. He has steadily refused operation, but the case we believe to be one of unilateral nephritis with hæmaturia as the initial symptom and a nephrotomy certainly indicated.

Just how nephrotomy helps these patients is quite an interesting question, but it is to be presumed that it relieves congestion and by dissolving the continuity of the blood vessels in some way interferes with the afflux of blood.

Experience has shown that nephrotomy has a favorable influence on the hæmorrhage and pain of toxic nephritis and owing to the compensating hypertrophy of the intact parts of the kidney, the functional capacity does not seem to be lessened by incision and prompt suturing. Furthermore, in not a single case reported in literature has this procedure of a simple nephrotomy failed to relieve this so-called *essential* hæmaturia.

A SERIES OF EXPERIMENTS TO DETERMINE THE CAUSE OF THE SO-CALLED IDIOPATHIC HÆMATURIA [1]

The experiments so far performed have been conducted for the purpose of excluding certain acutely developing vascular changes as being the principal cause for the occurrence of blood in the urine.

In the clinical condition in which this so-called idiopathic hæmaturia develops, one of the constant findings at operation is either a patchy or diffuse fibrosis of the kidney. In addition to these interstitial changes, chronic changes involving the glomerulus are fairly constantly seen, which with certain limitations might be called a glomerulonephritis. In this connection the question naturally arises as to whether the glomerular changes

[1] From the Pharmacological Laboratories of the University of North Carolina.

should be separately emphasized, or whether these changes should be considered as an essential part of the localized or diffuse fibrosis, the fibrosis in a given case being especially marked in and around the glomerulus.

In the experimental investigation, the dog was the animal constantly employed.

The experiments naturally fall in three groups:

First. Those experiments in which it was attempted to induce a hæmaturia by interference with the vaso-constrictor nervous mechanism of the kidney.

Second. Those experiments in which a hæmaturia was attempted by the introduction of a nephrotoxic substance into the renal artery which had a special affinity for the vascular element of the kidney.

Third. Those experiments in which the blood supply to the kidney was interfered with by clamping the renal artery by the use of a clamp devised by G. W. Stewart of the Cushing Laboratory of Experimental Medicine.

EXPERIMENTS OF THE FINAL SERIES

The vaso-constrictor nerves of the kidney reach the organ by two pathways: one set of nerves passes in along with the renal artery, while the other and minor set enters the upper pole of the kidney, entering the organ from the suprarenal body.

In this series of experiments three animals were employed. The left kidney was delivered by a transperitoneal operation and cleared of its surrounding fat. By careful dissection all structures going into the organ were severed, except the renal artery, vein and ureter. As a result, by cutting the vaso-constrictor nerves there followed an acute vaso-dilatation of the renal vessels and an acute congestion of the kidney. For two days following the operation the urine was slightly increased in amount, contained a trace of albumen and occasional hyaline casts and erythrocytes. Following this period the quantity of urine returned to the normal, the albumen disappeared and with this disappearance the casts and the occasional erythrocytes also disappeared. The animals made complete recoveries.

EXPERIMENTS OF THE SECOND SERIES

Three animals were used. The left kidney was exposed in the manner previously described. Into the left renal artery was injected 10 m.grs. of sodium arsenate. The kidney was replaced and the abdominal wound closed. During the succeeding three days the quantitative output of urine showed first an increase, followed by a slight decline. The urine was albuminous and contained only a few erythrocytes. At the expiration of the time the animals were killed. Histologically the kidneys showed an acute dilatation of the glomerular vessels with but slight involvement of the epithelium. In the third animal an interstitial exudate was beginning to develop.

EXPERIMENTS OF THE THIRD SERIES

In these animals, after delivering the kidney, the renal artery was compressed with Stewart's clamp. In the first animal the compression was unintentionally very nearly complete. The output of urine by this animal was lessened. The urine was not albuminous and showed no histological elements.

With the remaining two animals the compression of the artery was partial. The urine following the operation was slightly decreased, showed a trace of albumen, a few hyaline and granular casts and erythrocytes. The animals were killed by chloroform on the fourth day. The kidneys showed cloudy swelling of the epithelium and occasional zones of coagulation necrosis.

An apology for the small number of experiments is in order, but they conclude one step in our work and we record them to prevent repetition in other hands. In addition, they apparently indicate that the condition known clinically as "idiopathic hæmaturia" is not dependent upon: first, an excessive amount of arterial blood reaching the kidney; secondly, it is not dependent upon an acutely developing vascular injury; thirdly, it is not induced by lessening the quantitative input of arterial blood, lowering the kidney arterial pressure and inducing a passive congestion by interfering with the arterial side of the renal circulation.

These experiments would apparently contravene Klemperer's theory of angioneurotic œdema, and also Albarran's idea of a slight lesion of nephritis being a sufficient cause of the unilateral hæmaturia.

Finally, if we may be allowed to theorize, it seems most probable, since acute nephritis can be eliminated, that the clinical condition is due to a chronic type of nephritis; one in which there is a rupture of a glomerular vessel and the bleeding kept up by the high local pressure so constantly found in chronic nephritis.

RETROGRADE INCARCERATED HERNIA: HERNIA "EN W"

By LOUIS FRIEDMAN, M. D., New York City
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IN 1895, Maydl (3) reported two cases of strangulated hernia: the sac contents in one case was a loop of appendix, its distal end remaining within the abdomen; in the other the sac contained a loop of Fallopian tube, its distal end within the abdomen. In both cases the distal portions of these organs were gangrenous, while the proximal, being within the sac, showed only moderate interference with its blood supply. He coined the term for this type of strangulation "retrograde incarceration," understanding thereby that the incarcerated portion of a herniated organ lies not in the hernia sac, but within the abdomen near the hernia constricting ring, while that part of the organ lying toward the periphery from the hernia orifice and within the sac is either nearly normal or usually shows evidence of only moderate interference with its blood supply.

In retrograde incarceration of intestine, two or sometimes three distinctly separate loops of gut are found in the hernia sac, while the incarcerated loop or so-called "connecting loop" (Verbindungsschlinge) is within the abdomen near the hernia orifice.

De Beule (25) aptly gives it the descriptive name of hernia "en W," the two loops in the sac with the one loop in the abdomen resembling the form of the letter "W."

Benno Schmidt's (1) case seems to be the first one on record, a woman dying from the effects of a large strangulated umbilical hernia. At autopsy several loops of unchanged small intestine were found in the sac, while near the constricting ring there was an incarcerated loop within the abdomen, completely gangrenous. Lauenstein (2), in 1894, first described this unusual and interesting form of strangulated hernia.

Since then, while a number of papers and case reports have appeared in German literature about retrograde incarceration, there is but scant reference in American literature; none of the books on surgery mention it, and no paper dealing with the subject nor any case reports have so far appeared. *Progressive Medicine*, June, 1912, gives an extract of two of Lauenstein's cases, the only other reference being in Sultan's translated work on "Abdominal Hernias." While an uncommon type of hernia, it is of sufficient importance that a thorough description of it should be incorporated in every text-book on surgery.

My own case, which was reported before the Harlem Medical Association, was not recognized by me as one representing "hernia "en W" with incarcerated "connecting loop," and in my report then I made mention of the interesting point that a gangrenous loop of gut was pulled out of the abdominal cavity, while the loops in the sac were but moderately strangulated. In speaking to Dr. Alexis V. Moschcovitz of New York about the condition found, he called my attention to the fact that it was one of retrograde incarceration, for which enlightenment I herewith thank him.

He has had two cases, in one of which he made the diagnosis of incarcerated "con-

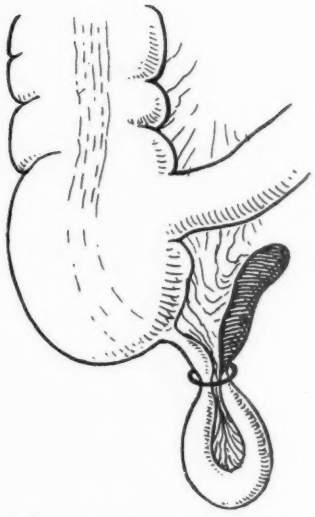

Fig. 1. Retrograde incarceration of appendix.

necting loop" before operation. In either case resection was indicated. (Personal communication.)

Report of case. The patient, a physician 70 years of age, was admitted to the Sydenham Hospital on August 22, 1910. He had had for twenty years a left inguinoscrotal hernia, always reducible. On the morning of August 22 it suddenly became strangulated, and efforts at reduction by taxis proved unsuccessful. Vomited twice. Admitted to the hospital at 5 P.M.; operated 8 P.M.

Examination showed a large inguinoscrotal tumor the size of a man's head reaching to the middle of the thigh, very tense, painful, tympanitic. Pulse 100. Temperature normal. Chloroform anæsthesia.

Incision parallel with Poupart's ligament; constriction at external ring; considerable fluid in sac, and several loops of small intestine, reddish blue, œdematous, but responded promptly to application of heat. Upon enlarging the ring, a great quantity of moderately bloody fluid escaped from the abdominal cavity, and pulling on one of the loops of gut, a coil of intestine 19 inches long, deep reddish blue in color, œdematous, the peritoneal covering of which had lost its characteristic glistening appearance, came into view. Its mesentery contained several areas of hæmorrhages, while pulsation in the vessels was absent. The mesentery of this incarcerated loop was within and caught in the grip of the hernia orifice (Fig. 4). The constriction rings on the loops of gut within the grasp of the hernia orifice were normal in color.

Application of heat to this intra-abdominal loop did not restore its vitality; resection, with end-to-end anastomosis, Murphy button, was therefore done, the hernia repaired, Ferguson method. Patient stood the operation well, which lasted an hour and fifteen minutes.

Highest post-operative temperature 102°; pulse 110. Passed flatus the next day; bowels moved on the fifth day. Button passed on the thirteenth day. Uninterrupted recovery.

In retrograde incarceration the organs involved may be the appendix (Fig. 1), Fallopian tube, a Meckel's diverticulum, omentum and intestine, most often small intestine. When gut is involved, the hernia is usually of large size and long standing; the majority of cases recorded were in patients past middle age. Exceptions were: Takayasu's (27) patient, a boy 7 years old; Polya's (9) case, an acute hernia with incarceration in a male 23 years old; and Lauenstein's (2) first case, a young man of 24, also acute hernia. Right-sided inguinoscrotal type was the most frequent—femoral in a few, umbilical in one, inguino-properitoneal in one.

In the sac are found, side by side (Fig. 4) or one behind the other, two distinctly separate loops of gut, the incarcerated loop or "connecting loop" being within the abdomen near the hernia orifice, its mesentery sometimes caught in the grasp of the constricting ring. In a number of cases cæcum and appendix (Fig. 3), with a distal loop of ileum, were in the sac, while the proximal loop, incarcerated, was in the abdomen. Cases reported by V. Wisting-

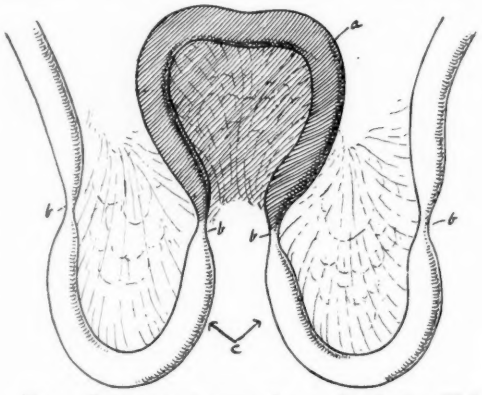

Fig. 2. Retrograde incarceration, or hernia "en W," as it would appear spread out. (*a*) Abdominal loop; (*b*) constriction rings; (*c*) loops in sac.

hausen (5), Pringle (10), and Siebert (21) contained three loops of gut in the sac and two connecting loops in the abdomen.

It is most always the "connecting loop" found within the abdomen which suffers more and evidences grave interference with its blood supply; the loops within the sac may be normal or only moderately strangulated. In a number of instances the "connecting loop" was resected; in a very few the loops within the sac, as well as the connecting loop, needed such attention.

It is interesting to note that the constriction rings (Fig. 2) on the loops of gut, that is, which are within the grasp of the hernia orifice, show as a rule no interference with its blood supply, although gathered together in ribbon-like folds and furrows, and appear in high contrast as a line of demarcation between the loops within the sac and that within the abdomen. This was very marked in my own case.

Thrombosis of the mesenteric vessels, with hæmorrhagic infarcts in the mesentery, is present in severe grades of "connecting loop" incarceration. Some observers believe that the thrombosis is a primary pathological condition.

Increase in the length of the mesentery of the small intestines due to stretching has been noted, particularly in old subjects with long-standing large hernias (Klauber and Lauenstein).

A highly important and striking fact is the extreme rapidity of gangrene in the incarcerated connecting loop. Fluid is mostly always present in the abdomen; it may be either clear, turbid, or bloody. Bloody stools follow where resection was not necessary, showing the intense engorgement in the incarcerated loop.

1. What causative factors enter into the formation of a retrograde incarcerated hernia?

2. Why is the blood circulation in the "connecting loop" usually more interfered with than the loops in the sac?

The theories advanced have been many, but so far satisfactory or plausible explanation is still wanting in answer to the first question. Theories are that:

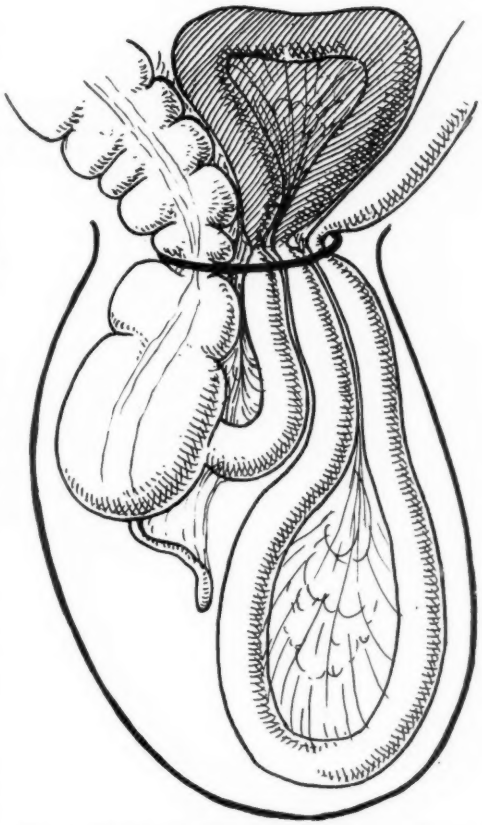

Fig. 3. Hernia "en W" with cæcum, appendix, and portion of ileum in sac. Incarcerated "connecting loop" in abdomen.

1. Originally a continuous loop of gut herniated into the sac, and that its middle portion prolapsed back into the abdomen.

2. By taxis the loop of gut was forced back into the abdomen (Wistinghausen).

3. Retrotraction of gut through forces within the abdomen (Neuman).

While all this may be possible, it is hard to prove satisfactorily, and may occur only where a large ring is present, which is not always the case. Taxis for reposition was not even attempted in many cases reported. It seems to me that a positive explanation is not at hand, and we must accept the fact that, particularly in large hernias, two distinctly separate loops of gut can prolapse

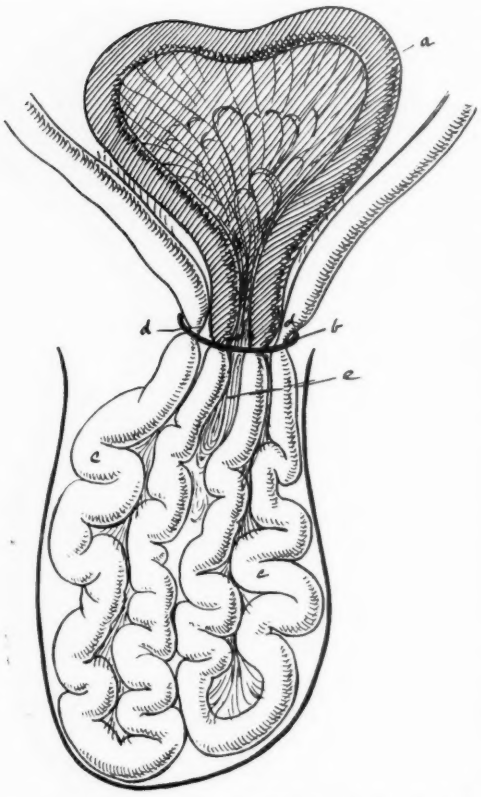

Fig. 4. Diagrammatic presentation of the author's case of hernia "en W." (*a*) Gangrenous loop in abdomen; (*b*) hernia orifice; (*c*) loops in sac, moderate strangulation; (*e*) mesentery of incarcerated "connecting loop."

into the sac, while its connecting loop coincidently remains in the abdomen.

Of greater interest is the answer to the second question. In my own case the mesentery of the incarcerated connecting loop was within the grasp of the hernia orifice, and so directly, either by pressure or by kinking on the sharp edge of the ring, its blood supply was shut off. Jackh (15), Klauber (8), and Haim (12) found the same conditions present in their cases, while Neuman (23) and Sultan (22) observed that the mesentery of the incarcerated loop was not within or caught at the constricting ring, and yet its vascular supply was interfered with. Viewpoints on the second question are:

1. Direct pressure and constriction at hernia orifice upon mesentery and its vessels.

2. Torsion of the mesentery on its long axis, with a fixed point at hernia orifice.

3. The extraordinary pull and tension exerted upon the mesentery of the "connecting loop" by the loops and its mesentery situated within the sac: Neuman (23), Lauenstein (20), and Sultan (22).

4. The mesentery of the connecting loop passes the constricting ring twice by doubling upon itself, so producing interference with blood supply: Maydl (3), Klauber (8), Haim (12), and Jackh (15).

Neuman, in his case, during operation demonstrated to his assistants that he could readily interrupt the circulation in the mesentery of the connecting loop by strongly pulling upon it at its root.

Gangrene has occurred in one or two loops found within the sac, while the connecting loop was normal.

Experiments on dogs have been carried out by Takayasu (27) and Lauenstein (17 and 41) to determine if possible the manner in which circulation is interfered with in the incarcerated loop.

While it is highly interesting to determine what the mechanism may be whereby this form of strangulation is produced, or how and why the vascular supply is interfered with more readily in the connecting loop, the practical indications are more important: to know and to remember that such retrograde incarceration does occur; to be on the lookout for it, particularly so in large, long-standing hernias where strangulation has occurred; to recognize and interpret the symptoms and signs which the incarcerated loop does bring forth; to always investigate where free fluid, particularly bloody, escapes from the abdomen when liberating the hernia constricting ring, so that the possibility of overlooking the incarcerated loop lying within the abdomen may not occur.

The symptoms and diagnostic signs will depend upon local conditions within the sac, as in ordinary strangulated hernia, but the

principal and characteristic signs depend upon the incarcerated loop within the abdomen.

The following have been observed as being present in the few cases reported:

1. Large size tumor in scrotal region, sometimes asymmetrical, due to the distended separate loops.
2. Colicky pain in lower abdomen, on the side of the hernia; pain on pressure on side of hernia, right above Poupart's ligament.
3. Rigidity above Poupart's ligament on side of hernia.
4. Local tympany, due to the distended incarcerated loop.
5. Presence of sausage-like mass in lower abdomen, on side of hernia.
6. Perceptible asymmetry of lower abdomen, the hernia side being higher.
7. Dullness on percussion in flanks, due to fluid, and perceptible fluid wave.
8. Blumberg's sign of peritoneal irritation may be present.
9. Greater abdominal than scrotal tenderness.

After opening the hernia sac:

1. The presence of two or three separate loops of gut.
2. Escape of fluid, clear or bloody, from the abdominal cavity after cutting the constricting ring.

The time elapsed since incarceration has taken place will naturally vary the degree of symptoms present.

Because of the extreme rapidity of gangrene in the incarcerated loop, early operation is of great importance.

So that, given a long-standing, large size hernia which has become strangulated, where there is either pain, rigidity, tumor mass immediately above Poupart's ligament on the side of the hernia, with asymmetry of lower abdomen, a tentative diagnosis of hernia "en W" may be made; while if such signs are not present or are not interpreted correctly, when upon operating there are present two or three *distinct* loops of gut in the sac, with escaping fluid from the abdomen, an incarcerated connecting loop is to be thought of and looked for. So far about 30 cases have been reported—with my case and two of Dr. Moschcovitz, 33.

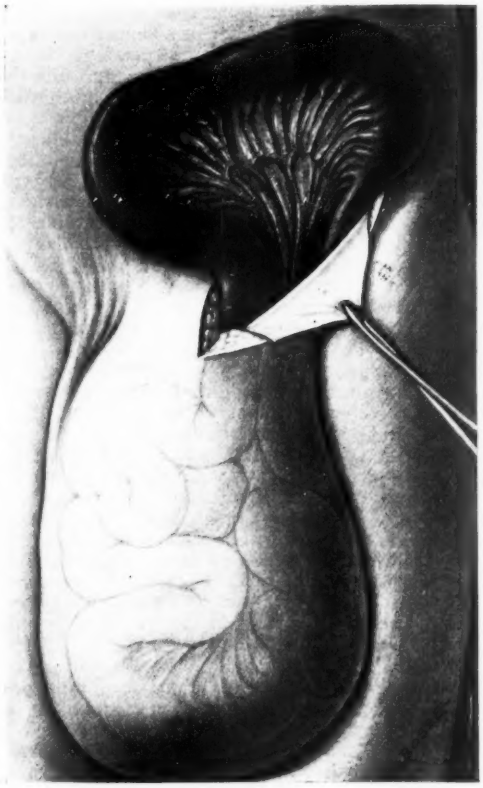

Fig. 5. Author's case of retrograde incarcerated hernia.

CONDENSED EXTRACTS OF SYMPTOMS AND PATHOLOGY FOUND IN SOME CASES REPORTED

1 (Lauenstein, 1893). Patient 24 years old. Acute hernia. Right inguinoscrotal tumor, size of three fists. Mass tympanitic, irregular in outline. Two loops of gut in sac, third loop in abdomen. Connecting loop deeply injected. No resection.

2 (Lauenstein). Fifty-two years old. Right inguinal hernia for 34 years. Right scrotal region size of child's head, tympanitic. Strangulated 2 hours. Abdomen distended and painful on pressure. Hernia sac contained two loops of gut; on mesentery several spots of infarcts. Connecting loop in abdomen, deeply injected. No resection.

3 (Lauenstein). Fifty-eight years old. Large size, old-standing hernia. Right inguinoscrotal tumor size of child's head. Strangulated 12 hours. Abdomen tender. In sac, cæcum, appendix, and ileum. Incarcerated loop small intestine 65 cm.; dark red, mesenteric infarcts. Resection. Death.

4 (Lauenstein). Forty-seven years old. Since childhood, right-sided inguinal hernia. Tumor

right scrotal region size of child's head. Great pain in right lower quadrant of abdomen. In sac, two loops, one 24 cm. the other 48 cm. long. Connecting loop in abdomen, 80 cm. long. Bloody serum in abdomen. Constriction rings on intestine evidence no circulatory disturbance.

5 (Lauenstein). Male, age 50. Since childhood, left-sided hernia. Operated 2½ hours after strangulation. Scrotum tympanitic. Asymmetry lower abdomen. Left more distended than right. Cæcum and ileum found in left-sided hernia sac. Connecting loop of ileum in abdomen.

6 (Lauenstein). Seventy-three years old. Twenty-eight-year-old right-sided hernia. Scrotum asymmetrical. Right lower abdomen more resistant than left and more distended. Asymmetry lower abdomen. Two loops with its mesentery in sac, densely congested. Bloody serum from abdomen. Third loop incarcerated; pulled out of abdomen.

7 (Lauenstein). Patient 67 years old. Right-sided hernia, 20 years' standing. Operated one hour after strangulation. Scrotal tumor size of man's head, elastic, tympanitic. Two loops in hernia sac, congested, punctiform hæmorrhages in mesentery. Third loop in abdomen, deeply congested; its mesentery also deeply congested.

8 (Enderlen). Patient 58 years old. Since 8 years ago, double hernia. Right-sided incarceration, size of man's two fists. No abdominal symptoms present. Two loops in sac, one in abdomen. Resection of all three loops.

9 (Haim). Right inguinal. Scrotal tumor size of two fists. Abdomen in right lower quadrant rigid, tender on pressure. Dullness on percussion in flanks. Much reddish fluid in abdomen.

10 (Jackh). Patient 74 years old, female. Femoral hernia, right side. Right above Poupart's a mass distinctly palpable, sharply defined, distended, tympanitic, making the impression of distended gut. In sac, two loops of gut; in abdomen, connecting these loops a third one, dark red, deeply injected; hæmorrhagic infarcts in mesentery. Intestines in sac hardly injected. Bloody fluid in abdomen. Resection. Recovery.

11 (Jackh). Patient 63 years old, male. Old-standing scrotal hernia, right side; lower part of abdomen on that side distended; visible peristaltic movements. Great rigidity on this side, tympanitic. In sac, one small loop of ileum and cæcum. In abdomen, portion of ileum 65 cm. long, great deal more injected than sac contents. No resection.

12 (Sultan). At autopsy inguinoproperitoneal hernia present. In sac, two loops of small intestine, third loop in abdomen; gangrenous, with perforation.

13 (Klauber). Fifty-seven years old. Right-sided inguinal hernia, long standing, scrotal. Moderate distention, not very painful. In sac two loops, unconnected. Third loop in abdomen, 25 cm. long. Vessels of mesentery thrombosed. Bloody serum in abdomen. Resection. Recovery.

14 (Polya). Age 23. Acute hernia after lifting a heavy object. Right side, scrotal, painful, mass size of man's fist. Operation 10 hours after accident. In sac, two loops of gut, the tip of the appendix adherent to lower pole of sac. Third loop, which was ileum, in abdomen, greatly more injected than sac contents.

15 (Polya). Sixty-two years old. Four-year-old right-sided inguinal hernia. Abdomen distended, tender. Distinctly palpable, sausage-like mass to be felt above Poupart's. In sac, cæcum and appendix, part of ileum, deeply injected. In abdomen, brownish red fluid and loop of ileum, gangrenous.

16 (v. Wistinghausen). Thirty-four years old. Right scrotal, size of two fists. Pain on pressure in right lower abdomen, above Poupart's. Sac contained two distended, blue-red, small intestinal loops. Fluid in abdomen. Incarcerated loop, 80 cm. long, in abdomen, gangrenous. Death.

17 (v. Wistinghausen). Seventy-two years old. Right-sided inguinal, old standing, large size. Incarcerated 12 hours. Three loops in hernia sac, all of different color. Another loop in abdomen, gangrenous, and mesenteric vessels thrombosed.

18 (Heller). Seventy-six years old. Since 15 years ago, left-sided inguinal hernia, lately not reducible. Left lower quadrant more tender then right. Rigid, dullness in flanks. Two gangrenous loops in sac. In abdomen, third loop, gangrenous. Bloody fluid present. Resection.

19 (Neuman). Seventy-five years, female. Double femoral since 30 years ago. Right side strangulated, size child's head. Pain in abdomen. Somewhat distended, soft except right lower quadrant, painful on pressure. Active peristalsis visible. In sac, omentum and two loops of gut, injected. Fluid in abdomen. Incarcerated loop in abdomen, blue-black, twice as long as those in sac.

20 (Takayasu). Boy 7 years old. Right inguinal hernia several years' standing. Strangulated several hours, mass size of man's fist in scrotum. Abdomen distended, painful on pressure. In sac, cæcum and appendix, deeply injected and distended. Bloody floccular fluid in abdomen. Near hernia orifice, 40 cm. long, small intestine, blue-black-Resection. Death.

21 (Manninger). Fifty-six years. For many years right inguinal hernia. Strangulated 14 hours. Elastic mass in right inguinoscrotal region, not painful. Lower quadrant of abdomen on this side rigid and extremely painful. In sac, cæcum and 15 cm. long ileum. Both considerably injected. Near orifice a smaller loop. In abdomen great quantity of bloody exudate and one-meter-long small intestine, gangrenous. Mesenteric thrombosis. Resection.

22 (De Beule). Right femoral. Resistance in right iliac fossa, great tenderness. Palpable distended loop in abdomen.

23 (De Beule). Right inguinal. Resistance in right iliac fossa and hypogastric region.

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A CONTRIBUTION TO THE STUDY OF PITUITIRIN[1]

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A. THE EFFECT OF PITUITIRIN ON NORMAL AND ELEVATED BLOOD PRESSURES

DURING the last year many articles on the use of pituitirin in obstetrics were published, especially in Germany, and the use of this agent in certain atonic uterine conditions (1) has been widely adopted. In reading these reports one is impressed by the contra-indications to its use outlined by some and by the indiscriminate methods of administration in the practice of others. Because of the marked rise in blood pressure (2) and the lowering of the pulse (3) observed in animal experimentations, it was very early advised that pituitirin be withheld in such cases as show arteriosclerosis, elevated blood pressure, valvular lesions of the heart, whether com-

[1] Inaugural thesis for American Gynecological Society, 1913.

pensated or not, myocarditis and nephritis, and this advice is frequently repeated. The author has used pituitirin now for a variety of conditions, therapeutically and experimentally, during the last thirteen months, and, whenever conditions permitted, blood pressure and pulse readings were kept and the by-effects of the therapy were noted. It is the purpose of this paper to record some of the results as influenced by the method of administration and to draw certain conclusions therefrom.

Most of the observations here related were made upon normal women who had already been delivered and, except as specifically noted, no patient who had fever or any of the above-mentioned contra-indications was treated with pituitirin. The dose given in each case was the same,—1 cc. of solution containing .1 gram of the posterior lobe of the hypophysis.

Pituitirin was given subcutaneously to seventeen women during the puerperium whose blood pressures ranged from 100 to 134. None experienced any systemic sensations or showed any peculiar changes at the injection point.

Among those who were treated intramuscularly were eleven whose readings were taken before and for sufficiently long a time afterwards. Of these, five showed an increase in blood pressure of from eight to twelve millimeters. The most marked pulse lowering was eight beats to the minute. These reactions appeared within five minutes and were over within fifteen minutes. The rest showed no unusual variations. In none of the eleven were any unpleasant symptoms produced.

In all cases where no reaction was obtained the tension was taken at frequent intervals up to one hour after injection time. In every case where the uterus was palpable it could be felt to harden after the subcutaneous and intramuscular injections.

The following chart records the results of the intravenous injections which were given during an effort to determine the action of pituitirin upon the lactating breast:

Case	No. 1 BP	P	No. 2 BP	P	No. 3 BP	P	No. 4 BP	P	No. 5 BP	P	No. 6 BP	P	No. 7 BP	P	No. 8 BP	P
Before	118	76	114	96	142	76	130	80	140	110	126	86	120	108	114	80
3 min	...	..	150	66	200	54	180	60	?	100	...	..	146	60	152	64
5 min	128	66	130	84	170	60	175	66	159	78	140	68	?	72	128	76
10 min	125	68	110	84	160	72	160	70	144	99	120	74	140	72	125	80
15 min	122	70	108	96	150	78	140	78	142	106	122	86	132	96	...	..
20 min	118	74	...	..	...	..	...	..	...	...	...	..	...	...	110	80
30 min	...	..	...	..	145	78	128	82	134	114	...	..	...	...	...	..
45 min	...	..	...	..	140	74	132	80	...	...	...	..	118	115	...	..

Care was taken to select a place where there would be the least chance of puncturing a vessel. A drop or so of blood escaped upon withdrawal of the needle in two cases, however, so that it is possible that in these two some of the fluid was injected into a vessel. One of the two had an increase in pressure of eight points and a fall in the pulse of eight beats, which appeared within five minutes after the injection. The reaction was over within ten minutes and was unaccompanied by any symptoms. In all the other cases there was no variation greater than four points in pressure and six beats in the pulse, and the most escaped any change in pulse or pressure.[1]

[1] Howell did not obtain any effect on blood pressure after subcutaneous injections in animals.

In case No. 1 there was some difficulty caused by a dull needle, and it was doubtful at the time of injection whether the vein had been well entered. It will be observed that there was less reaction on pulse and pressure produced than in any of the following seven. The patient also escaped all of the symptoms of which the others complained. The injection was without difficulty in the other seven, and in each a well-defined effect was produced —an almost immediate high rise in blood pressure and outspoken slowing of the pulse. Within a minute each appeared bloodless and cadaverous and complained of feeling queer and dizzy as though succumbing to the influence of an anæsthetic. These sensations were in every case of short duration and began

to disappear as soon as the blood pressure began to lower and lasted in no case longer than three minutes. No patient had any unpleasant after-effects. In almost every case there was a fall of the tension to slightly under normal, accompanied by a slightly increased pulse frequency immediately following the pressure rise. This decreased tension lasted but a brief while, though the chart is not instructive regarding the duration.

The symptoms produced in patient No. 3 were rather alarming. Almost immediately upon injection she spoke of feeling "funny"; she became blanched and pinched in appearance, felt somewhat nauseated, was anxious, broke out in a cold sweat and really appeared very ill, though she complained of no pain. The blood pressure jumped within 1½ minutes from 142 to 200 and the pulse dropped from 76 to 54, and for part of a minute the heart was much slower—ten beats to fifteen seconds. The unpleasant symptoms were synchronous with the rise in blood pressure and began to disappear as the tension decreased. The patient felt entirely comfortable again within fifteen minutes. In all eight cases the uterus gave some evidence of marked contraction: either it was palpated as a stone-hard ball, or the patient had an after-pain, or lochia was felt to escape from the vagina.

The variation noted between the different methods of administration is probably dependent upon the rapidity of the ingress of the blood-pressure-raising substance to the circulation. By the intravenous route the entire amount gains immediate entrance, while by the intramuscular route very often portions are injected into the lumina of small vessels. When given subcutaneously the absorption is slow enough so that the blood pressure is able to maintain its equilibrium.

It has been shown that the rise in blood pressure is due to the contraction of peripheral arterioles, (2) and that the coronaries share in this contraction (4–5). In view of this and of the facts here related concerning normal individuals, the method of administration of pituitirin cannot be a matter of inconsequence.

The intravenous dose would seem to be contra-indicated in the class of cases mentioned, because of the great probabilities of harmful results. The resemblance of the symptoms in normal individuals after the intravenous injection of pituitirin, to those seen during an attack of angina pectoris is quite striking. In animals pituitirin causes an increased secretion of urine, (6) with vasodilatation of the kidney vessels, (7) so that it is doubtful if pituitirin administered to cases of nephritis unaccompanied by increased tension would produce any peculiarly harmful results.

In two cases of compensated valvular heart disease, in two of nephritis without high tension, and in a case of very high toxic blood pressure, where indications for the termination of labor arose while the fœtus was still in a difficult position for forceps, pituitirin was administered subcutaneously with gratifying results, without any demonstrable effect on the circulation.

Because of the possibility of an undiagnosed condition contra-indicating an upright increase in blood pressure and arteriole contraction, the intravenous administration of pituitirin is unsuited to routine use and it should be reserved for desperate emergency cases where the immediate action of the extract is highly desirable, as in severe postpartum hæmorrhage. Where a fairly rapid result is wanted, the intramuscular administration is much safer. For general use the subcutaneous injection should be employed, since it is uniformly without possibilities of harmful blood pressure effects and is as safe as far as the skin is concerned as is the ordinary hypodermic medication.[1]

B. THE ACTION OF PITUITIRIN ON THE LACTATING MAMMARY GLAND

Ott and Scott (8) found that in a lactating goat the rate of milk-flow measured by the insertion of a cannula into the mammary gland was increased one hundred fold by the injection of the extract of the posterior lobe of the hypophysis. The period of the increased rate of flow was short, but could be re-established, though to a lesser degree, by

[1] Bell thought trouble might follow subcutaneous injections because of vaso-constriction.

a second injection. Schäfer and Mackenzie, (9) working with lactating cats, obtained the same results. On the basis of these experiments the galactogogic action of pituitary extract was asserted.

In order to test the effect of pituitirin upon the lactation of human mothers, it seemed wisest to experiment with patients who had passed the puerperium. During the first weeks after delivery so much depends upon the general physical and mental condition of the patient that the effect of medication upon milk production is hard to determine with any degree of certainty. Nevertheless, it was felt that something might be learned from patients in the puerperium where there was no child, since in them, at any rate, the galactogogic action of the child's nursing could be eliminated. Normally there occurs after abortion or delivery, at a variable time from the second to the fourth day, the breast reaction, which is marked by engorgement of the gland and discomfort or even pain. If nursing or pumping is not permitted, the pain after twenty-four to forty-eight hours abates, the reaction disappears and the breast gradually dries up. Assuming that pituitirin stimulates the milk production, then it should reinstate the engorgement and consequent discomfort, if given when the breast reaction is beginning to subside.

Two cases that had aborted and five that had given birth to a dead child at or near term were used in this test. The bowels were well evacuated the day following delivery, and as soon as the breast reaction occurred, cathartics were discontinued, daily cleansing enemata were administered when necessary and the fluid intake limited to one quart a day,—these measures being adopted in order that the breasts might be subjected as nearly as possible to constant conditions during the experiment. On the second or third day after the beginning of the reaction, when the patient had stated that she had been free of discomfort in the breasts for a period of from six to twelve hours, an injection of pituitirin, containing .1 gram of the posterior lobe of the hypophysis to one cubic centimeter of solution, was given. The initial injection was in three cases intravenous; in two, intramuscular; and in two, subcutaneous. All received a subcutaneous dose on each of the two succeeding days. In six cases the breasts steadily decreased in size and there was no recurrence of discomfort. The pituitirin was to all appearances without influence. In one case there was recurrence of pain in the breasts the night following the first injection. Examination of the history of the patient showed, however, that in the twenty-four hours preceding the injection of the pituitirin there had been numerous watery defecations, resulting from a saline cathartic prescribed by an interne who was unacquainted with the observations to be instituted, while on the day of the injection there had been no evacuation at all. The day following, the patient was again comfortable and the breasts began to decrease in size rapidly in spite of the succeeding doses. Blood pressure readings showed an increase in tension following all the intravenous administrations and after one of the intramuscular injections, while after the subcutaneous doses there was no pressure rise. In this class of cases no galactogogic effect of pituitirin could be demonstrated.

It was then decided to try pituitirin on a few mothers whose infants in consequence of a proved deficiency in breast supply had been for some time upon well-managed supplementary feedings. The accessory feedings were withdrawn and the child was weighed daily, as were also four successive feedings, alternating the breasts at three-hour intervals, beginning at the second regular feeding of the day. This routine was continued for two days preliminary to the first injection and a chart was kept. If a child showed a gain in weight or if there was a variation greater than one-half ounce between the feedings from the same breast at a like period on successive days, the case was considered unsuitable for the observation. From the cases which satisfied the requirements four were selected where the mother could be depended upon and the scales were reliable. The children varied from four to eight months in age. After having established an index to the normal secretion in the way mentioned, a subcutaneous injection of pituitirin was

given on the third day after the first weighed feeding, and a second injection was given at the same time on the next day. It was considered that if an increase of more than half an ounce occurred at any feeding above the normal average for that particular feeding, a galactogogic action might be suspected. No unusual variations were observed. All children had to resume supplementary feedings at the end of the observation period. In no case, on the first day of the injection, was there a variation exceeding one half ounce. In one case, on the evening of the second day, there was an increase of one and one half ounces above the average of the weights for the same breast but the reason ascribed to this was that the preceding feeding of that breast had been cut short one ounce by the arrival of an unexpected visitor. In one case the feedings were somewhat below the average. In this class of cases too it was not possible to demonstrate any galactogogic action of pituitirin.

Although these experiments failed to demonstrate any favorable reaction of pituitirin upon the human milk supply, C. B. Reynolds, (10) and Scott also, (11) reported seemingly beneficial results upon that class of cases which I had refused as open to too many errors, and the experiments of Ott and Scott, and Schäfer and Mackenzie still seemed to establish a favorable reaction in cases of animal lactation. Unless these results could be explained by some other hypothesis, they cast some doubt upon the validity of my own. My familiarity with the well-marked and extremely rapid effect of the intravenous administration of pituitirin on the smooth muscle fibers of the uterus suggested to me that the results obtained by the injection of pituitirin in lactating animals might be due to its action on the smooth muscle fibers of the breast, rather than to an increase of the milk secretion.[1]

For the purpose of testing this hypothesis I made a sort of a plethysmograph by connecting a hyperæmia bell with rubber tubing to an upright glass column. The apparatus was applied to the breast, was filled with water at body temperature and the height of the water column, together with its fluctuation due to respiration, noted. If the effect of the administration of pituitirin was to contract the smooth muscle fibers, then the breast would contract, and the water in the column descend; if, however, the effect was to increase the secretion in the breast, then the breast would swell and the water column ascend.

Five patients from the first week of the puerperium were taken for this observation. In all cases the same dose as before mentioned was given intravenously. Before the administration the blood pressure and pulse were taken, as well as at frequent intervals after the administration. In no case was there a swelling of the gland as interpreted by a rise in the water column. In three cases the effect was to produce a maladjustment of breast and bell, so that air rushed into the bell and spoiled the possible effect on the water column. In two cases where the breasts and chests were so shaped that better coaptation was maintained, there was a sinking of the water column of one and a half and two inches, respectively, beginning within one minute and reaching the maximum fall within five minutes of injection. The water remained at these low levels long after the blood pressure rise, which is due to vaso-constriction, had subsided. In one case, that of a II-para, delivered about 36 hours before, where already some milk could be squeezed from the nipple, the result deserves a full description. The blood pressure before injection was 114, the pulse was 80; the respiratory excursion of water column was one fourth of an inch. The patient was quiet and at ease. Within thirty seconds after the injection a fine threadlike stream of milk was ejected from the nipple into the clear water surrounding the breast. Corrugation of the areola began within a few seconds and when well marked the stream of milk ceased; probably less than one half drachm was ejected. At the same time the water column slowly descended the tube one and one half inches. The patient, like most patients who receive pituitirin intravenously, also became blanched and pale; she felt dizzy and queer. (B. P. 152, P. 64, at 2 minutes and 3 minutes after injection.) Her uneasy sen-

[1] Though it is known that certain hormones such as secretin may act very rapidly.

sations passed as soon as the blood pressure began to decline and she felt entirely recovered at the end of four minutes. (Return to B. P. 110 and P. 80 in 20 minutes.) The water column at the end of thirty minutes still remained low. Soon after the injection the uterus could be felt, hard as a croquet ball, raising up the abdominal wall and it remained contracted during the entire period of observation. The ejection of milk against the pressure of the surrounding water, the corrugation of the areola, the cessation of the flow when the corrugation of the areola became marked, the decrease in the size of the breast which lasted much longer than the rise in blood pressure, and the maladjustment occurring in three cases between breast and bell lead to the undoubted conclusion that we were dealing with a contraction of the smooth muscle fibers of the breast instead of with an increase in the secretion of milk.

A bitch which had recently whelped and was suckling one apparently somewhat premature, weak puppy, had cannulæ inserted into the ducts of two of her nipples and was given the same dose of pituitirin intravenously. Previous to the injection the breasts were pink and flabby and milk could be expressed from the gland only a drop at a time—evidently a subnormal supply of milk. Upon the injection of pituitirin the breasts almost immediately lost the natural pink and became a dead, whitish color; the thin skin about the nipples and over the breasts became markedly corrugated; the breasts got distinctly harder and projected from the dog's belly. No milk escaped from the cannulæ or nipples. In ten minutes the corrugations had disappeared, the breasts had returned to their normal pink and flabby condition and just as much effort was required as at the beginning to express milk from the nipples. Here we were dealing with an undoubted visible and palpable contraction of the breast tissue and had the breasts been full at the time of the injection, milk would probably have been ejected from the cannulæ. The deduction from these two practical experiments is that the effect of the pituitirin is to produce contractions of the smooth muscle fibers of the breasts in the same way as it is known to affect the smooth muscle fibers of the uterus (12) and intestine (13)and bladder (12).

The results obtained by the earlier experiments in animal lactation are probably evidences of this same effect rather than evidences of an increased secretion. The result of the second injection which Ott and Scott and Schäfer and Mackenzie observed is in accordance with the experience of Malinowsky (14) working on the uterine contractions in the human,—i. e. that a second dose reinstates the action of the first if it has abated, and augments the action if it is still in process. The reason that less milk is extruded on a second injection is that there is less milk to be squeezed out after the breast has been partly emptied by the first injection.

If an elevation in blood pressure produces an increased blood supply to a gland we have as a result increased gland activity. The elevation in blood pressure due to the administration of pituitirin, however, is the direct result of arteriole contraction and there is in consequence a decrease in the supply of blood to the gland. When added to this arteriole contraction there is also contraction of the smooth muscle fibers we should expect a marked diminution in the secretion of the gland.[1]

In conclusion it may be stated with some assurance that the results of experimentation with pituitirin upon lactating animals and humans do not support the assumption of its galactogogic effect. The stimulus which it appears in some cases to give to the milk flow

[1] Two articles upon this subject have appeared in the literature since the above paper was ready for publication. W. Govin, in an article entitled "On the Effects of Administration of Extracts of Pituitary Body and Corpus Luteum to Milch Cows" (Quarterly Journal of Experimental Physiology, Vol. VI, No. 1), records his failure to stimulate lactation in cows with a failing flow of milk. He relates that after intravenous injection of pituitary extract there was noticed an unusual distention of the teats ten to fifteen minutes after injection. He concludes as follows: "1. That under conditions of ordinary farm practice no commercial benefit arises from the administration to dairy cows of these glandular extracts, whether given by the mouth, by subcutaneous injection, or by intravenous injection. 2. That intravenous injection of pituitary extract may be followed by an increased collection of milk in the lower portions of the udder, but that, in spite of this, no alteration in the total quantity per diem or in the quality of the milk occurs. In the same issue of the same magazine is an article by E. A. Schäfer entitled "On The Effect of Pituitary and Corpus Luteum Extracts on the Mammary Gland in the Human Subject." Schäfer here relates that upon giving pituitary extract to a mother with failing lactation that she noticed tingling in the breasts, was able with a pump to withdraw more milk after than before injection, but that in spite of the continued use of the extract the milk gradually failed. He concludes that under the conditions of the administration neither the quantity nor quality were influenced by the extracts. The bulging of the cow's teats and the tingling in the woman's breasts were undoubtedly the results of contractions of the muscle fibers of the mammary glands, while the obvious failure of pituitary extract as a galactogogue is also evidenced.

should probably be explained by the effect in contracting the smooth muscle fibers of the breast and this very fact makes it probable that its continued administration would discourage rather than stimulate the secretion of milk.

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THREE-FINGER FLUCTUATION

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INCLUDING the method it is my purpose to describe, there are three ways of testing for fluctuation.

(*a*) The one-finger method. The student pokes the swelling with his right forefinger.

(*b*) The two-finger method. This is the method usually taught. The two forefingers are employed, one in an active, and the other in a passive rôle. With one the swelling is pressed upon, whereupon if fluctuation is present, the other finger is passively elevated. But across the course of a muscle, and in fat, this test gives a positive result which only the trained observer can distinguish from real fluctuation.

(*c*) The three-finger method. This is the one I wish to describe and to recommend. The tips of the two forefingers, and of the middle finger of the left hand are firmly planted upon the swelling, marking out an equilateral triangle of an area rather smaller than the limits of the swelling. The right forefinger is next sharply pressed into the swelling at right angles to its surface.

Fluctuation is present only if the two fingers of the left hand move away from each other horizontally in the plane of the skin at the moment when this is done. Any movement of the fingers in a vertical direction is to be ignored.

It will be seen that the method consists essentially in the artificial production of a true expansile impulse in an inelastic bag containing fluid. It is evidently not infallible for these conditions may be present to some extent in certain very soft encapsuled tumors.

This three-finger or expansile method of testing for fluctuation effectually distinguishes real fluctuation from the pseudofluctuation of substances such as muscle and fat. I shall be interested to know if such a simple device has occurred to others than myself.

DEPARTMENT OF TECHNIQUE

THE POST-OPERATIVE COMPLICATIONS OF PROSTATECTOMY [1]

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MOST of the data contained in this paper are the result of an experience in prostatic work extending over a period of fifteen years.

There is nothing so instructive to a surgeon as a careful review of his post-operative complications and unfortunate results, as it makes him more careful and lessens the liability of their repetition. It is very pleasant to think only of the good results. When we have a group of cases that do well we begin to feel that we are real surgeons, and it is just at this time that some unfortunate occurrence brings us back to earth again.

The first post-operative complication that we will consider is hæmorrhage. This usually occurs in the first 48 hours after operation. It is nearly always of venous origin, and can usually be controlled by pressure. We have had several cases that have had secondary bleeding during the first 36 hours following operation, all of which have been controlled by pressure.

The use of gauze soaked in adrenalin solution, if hæmorrhage is not controlled by iodoform packing, is valuable. One of the times when hæmorrhage is liable to occur is when the tube and packing are removed from the perineal wound, all of which can generally be obviated if peroxide of hydrogen be injected into the wound before an attempt is made to remove the gauze. The bubbling of the peroxide loosens the gauze, which comes away readily.

In suprapubic prostatectomy the hæmorrhage will usually be controlled by packing the capsule with gauze, as it is noted that the capsule immediately contracts down upon the gauze, thereby causing pressure. It is also possible at times to pick up the bleeding point and either ligate or control by forceps. I have recently had a case in which the hæmorrhage was controlled at once by passing a rubber catheter through the urethra, drawing it through the suprapubic wound, tying a knot in the eyed end, wrapping gauze around the knot and catheter shaft so as to form a plug. A silk suture was then passed through the catheter tip and brought out of the suprapubic wound to facilitate its removal. The catheter extending from the penile urethra was drawn forward, a small pad of gauze wrapped around the glans penis, and the catheter held in place by passing a safety pin through it at right angles to the axis of catheter. This patient had had profuse prostatic hæmorrhage for ten days, and thus being exsanguinated, it was highly important to guard against further bleeding after the prostatectomy. The packing and catheter were removed in 48 hours, with no return of hæmorrhage. Although I have not seen the patient since operation, his convalescence has been rapid. The only fatal case of hæmorrhage occurred in a perineal prostatectomy 12 days after operation The patient was up and about, with no fever and apparently doing well. He sat on the commode to defecate, and when he was found by the nurse he had fainted from loss of blood. On my arrival at the hospital the hæmorrhage had ceased, but the patient was practically moribund. After transfusion, the perineal wound was opened and the clots removed. Although the skin wound was nearly healed, in the deeper tissues there was no attempt at granulation. This patient had very marked arteriosclerosis and this probably accounted for the failure of tissue reaction, as there was no indication of sepsis.

Thrombosis may be one of the unfortunate results of prostatectomy. The only form with

[1] Read before the Southern Surgical and Gynecological Society, Old Point, Virginia, December, 1912.

which we have had any experience is the pulmonary. Young has had two cases of sudden death from this complication, one immediately following the giving of an enema. I have had one fatal case that occurred five hours after operation. The patient was a man 65 years old, in excellent condition, and was one of the simplest cases we have had. He was seen by a resident at 5 o'clock and found to be in good shape; at 5:15 he complained of shortness of breath and severe pain in side, and coughed up some blood and bloody mucus; in ten minutes he died. No autopsy was allowed, but it was unquestionably a case of pulmonary thrombosis.

Pneumonia is a complication, but if care be exercised it is rare. The administration of the anæsthetic in these cases is of the utmost importance, and in fact it is almost of more import than the operation. The secret is to just keep the patient under, and he ought to be out of the anæsthetic before leaving the operating room. Any success we have had in these cases has been due more than any one thing to careful etherization, and during the last few years to the employment of nitrous oxide and oxygen. At best these patients are all old men and supposedly bad cases for an anæsthetic. The inverted position of the patient in perineal prostatectomy unquestionably lessens the liability of mucus being carried into the lungs, and lessens in that way the liability to inspiration pneumonia.

Sepsis occurs less frequently in perineal prostatectomy than in suprapubic, on account of the drainage afforded by this route. If symptoms of sepsis do occur, nothing is so efficacious as salt solution by hypodermoclysis or tap water by Murphy's method in the rectum.

The use of continuous irrigation immediately following operation, both in the perineal and suprapubic routes, is one of our best methods of preventing sepsis; and in those cases that give evidence of sepsis, the two-stage operation, either perineal or suprapubic, with continuous irrigation for even as long as a week before the prostate is removed, will unquestionably save cases that otherwise would be lost. In cases of severe infection of the bladder it is well to have made up at the time of the operation, or before, an autogenous vaccine to help overcome this infection and to lessen the danger of sepsis or the severity of sepsis should it occur.

Uræmia is a condition that has to be very closely looked after, and preoperative treatment will in a large percentage of cases prevent this complication. The phenolsulphophthalein test as advised by Geraghty is of great importance in determining the functional activity of the kidney. A large percentage of these cases have diseased kidneys, either chronic inflammatory conditions or chronic suppurative conditions, and the patients to be looked after most carefully are those having large amounts of residual urine, as the relief of back pressure in the kidney during the drainage of the bladder makes them especially liable to suppression. If signs of this occur, salt solution combined with sweating and other appropriate treatment produces excellent results. Although a good deal is now being written against the use of salt solution, there is no question of its value in these cases, as a large percentage are unquestionably suffering from purulent infections of the kidneys. There is no one thing to which Young attributes his brilliant results more than to the free and oft repeated use of salt solution when indicated.

Patients suffering from diabetes are proverbially bad subjects for operation and are the worst class of cases for prostatectomy. We have lost one case of suprapubic prostatectomy from this complication. The patient, 76 years old, had symptoms of diabetic coma before operation, but under large doses of sodium bicarbonate his improvement was very rapid. He did very well for five days after the operation, when marked diminution in the amount of urine secreted was noted, the patient became comatose, and there was a marked excretion of acetone, the whole room being permeated with this odor.

My fourth death occurred from bichloride poisoning due to an attendant starting a continuous irrigation of 1:1000 bichloride immediately following the operation. This patient developed all the symptoms of bichloride poisoning: spongy gums, fetid breath, profuse diarrhœa, and an acute hæmorrhagic nephritis, the urine being made up almost entirely of blood casts. The bichloride continued running in this patient for about 20 minutes. After dressing I went in the ward to see how the patient was doing, and noticed the coagulated appearance of the fluid from the outlet tube. On pouring some of the fluid out of the fountain syringe and on tasting, it was found to be bichloride. Quarts of salt solution were used to irrigate the bladder, but enough absorption had already taken place to produce the marked poisoning already described, from which the patient died.

In the great majority of cases the relief of obstruction is complete if all of the obstructing portion of the prostate is removed. In perineal prostatectomy the operator can never be sure that this is true unless he takes the additional

precaution of passing his finger into the bladder to feel the internal urethral orifice after the prostate is removed. This was painfully brought to mind in one case in which I removed a very large prostate, but left a lobe coming from above the urethral opening that caused practically complete obstruction. It was necessary to perform a second operation, from which the patient finally had an excellent result.

There are some cases that are never able to entirely empty the bladder after prostatectomy, where from prolonged distention of the bladder and from prolonged cystitis the contractile power of the muscle is lost because of the infiltration of the muscle with inflammatory tissue. These patients are perfectly comfortable, and have no inconvenience from the ounce or two of residual urine.

The continuation of pus in the urine after prostatectomy is due to three conditions: first, the infected kidneys; second, to a pre-existing cystitis of years' duration, where the bladder mucosa is so badly diseased that it never recovers, and third, to the presence of diverticula in the bladder. These patients often experience no inconvenience, and can be kept perfectly comfortable with an occasional bladder irrigation. In other cases it is remarkable how a severe preoperative cystitis is perfectly cured by a prostatectomy and the consequent relief of obstruction. In fact some seemingly incurable cases of cystitis have been cured following operation.

Post-operative frequency of urination is due to two conditions: first, a contracted bladder, and second, a loss of control. Contraction of the bladder follows a certain percentage of prostatectomies, and can be overcome by careful bladder dilatation under hydrostatic pressure. I have had cases that could hold only three ounces, which by careful dilatation would at the end of three weeks hold as much as twelve ounces.

The cause of the loss of control after perineal prostatectomy is a debatable question. It is unquestionably due to the destruction of the muscle at the neck of the bladder, in the prostatic urethra, or in the membranous urethra. I have always used care in preserving the membranous urethra, and have had but two cases that have not eventually recovered from a temporary incontinence. Some cases of perineal prostatectomy are able to hold and void their urine from the time of removal of the tube, 24 hours after operation. Some of these patients have to be taught to hold their urine by having regular times to urinate, in the same manner in which children are taught. The late Dr. Sam Alexander of New York had what he called "his class in urinary incontinence," in which he filled their bladders with solution, had them pass a certain amount at his command, and cease urinating at the command "stop." By this method he has certainly produced some wonderful results.

Injuries to the peritoneum have occurred during both perineal and suprapubic prostatectomy, being followed by peritonitis causing the death of the patient. We have been fortunate enough to escape this complication. The complications which have probably brought the most disfavor upon perineal prostatectomy are recto-vesical and recto-urethral fistulæ. Unquestionably, when these complications develop from tearing of the bladder wall into the rectum and tearing of the prostatic urethra into the rectum, it is usually caused by too rough manipulation and by not separating with care the anterior wall of the rectum from the posterior surface of the prostate before any attempt is made to remove the hypertrophied gland. Care should always be taken after the removal of the prostate to pass the gloved finger into the rectum, to be sure that no tearing of the rectal wall has taken place. Should an opening be discovered it should be sutured at once. Another form of recto-urethral fistula occurs usually during the first week after operation. The cause of this is the necrosis of the rectal wall, due to a thrombosis from traumatism. I have had one such case where an opening about the size of a No. 12 French catheter persisted. Ten years ago I had one other case caused by the passage of a rectal tube through the rectal wall into the perineal wound. Young reports two cases breaking down after enema. Recto-urethral fistulæ will hardly ever occur in Young's prostatectomy if the levator ani muscles are brought together so as to afford the normal support and protection to the rectal wall. It is only necessary after exposing the posterior surface of the prostate to examine the anterior wall of the rectum with the finger in the rectum to see how thin this tissue is, to realize the amount of care it is necessary to exercise.

Since having this complication we have never permitted the use of a rectal tube or enema on any perineal cases. There are two methods of closing the fistulæ, and they both aim at closure of the rectal wound. If one can get either the rectal wound or the urethral wound to heal, of course you can heal the fistula; the urine flowing over the sutures is the complication that causes the infection of the sutures. The methods of obviating this are, first, by dissecting between

the rectum and the urethra, closing the rectal wall by catgut sutures after first freshening the edges of the opening; then performing a suprapubic cystotomy, so the urine will not escape through the urethra. The suprapubic drainage is kept up for about ten days and the bowels are not allowed to move for a week. The other method is that brought forward by the late Dr. Alexander, in which he reports 12 cases successfully treated by the following method: A careful dissection is made between the rectal and urethral walls as in the other method, and the rectal wall is sutured by two rows of sutures. A triangular piece of gauze of about six thicknesses is filled with a 10 per cent solution of iodoform and vaseline; this is then applied over the anterior surface of the rectal wound, extending to its highest point. The vaseline gauze protects the rectal wound from urinary infection. As the urine escapes from the urethral opening it flows over the vaseline-covered gauze as water runs off a duck's back. This one simple means undoubtedly simplified the treatment of the most distressing complication.

The deposition of calculi in the bladder or prostatic urethra sometimes occurs, those cases which have previously had vesical calculi being most liable to this complication. I have had one case which had a calculus form in the remains of the prostatic urethra. This patient was operated, and a silk traction suture was found that was the nidus of the calculus. He made a perfect recovery, and we have never used anything but absorbable suture since, even for traction in these cases. We have had one case of bladder calculus following prostatectomy, discovered one year after operation: the stone was crushed and evacuated; the patient has had no recurrence and is well at this time.

Epididymitis is not an uncommon complication, and some operators have gone so far as to advocate section of the vas to prevent its occurrence. We have had several cases, but they have all been mild, recovering readily under local treatment and support of the affected organ. I have, however, had one very severe infection; this occurred after suprapubic prostatectomy. This patient had a very severe colon infection of the bladder. The epididymitis which developed was followed by a large hydrocele. Within three days the fluid in the tunica vaginalis became purulent, and at operation the tunica vaginalis was found filled with stinking pus of fæcal odor. The patient was about his room in six days and made an uninterrupted recovery.

We have noted that some of our cases have had pain in the urethral canal during the first passage of urine through the normal channel after prostatectomy. In several of these patients the passage of urine has been followed by a typical urethral chill and high temperature. All the cases presenting this latter symptom have had badly infected bladders before operation. It is probable that the first passage of the infected urine through the unhealed urethra causes sufficient traumatism and consequent absorption to produce this condition.

We have had two cases of perineal prostatectomy in which there was a recurrence of obstruction. Care was taken in both cases at the time of operation to be sure every palpable portion of the prostatic growth was removed. One patient had less than an ounce of residual urine immediately after operation; after several years this gradually increased to from 4 to 6 ounces, and six years after the prostatectomy he developed complete retention. Cystoscopic examination showed no intravesical growth, but a median bar could be made out. Operative removal of the obstructing bar was followed by good recovery. The second case, operated on five years ago, was never completely relieved of residual urine, having 3 to 4 ounces after perineal prostatectomy. This patient before operation had had an enormously large, flabby bladder with from 16 to 18 ounces residual urine. The cystoscope showed a left lateral lobe projecting into the bladder, but no right lateral lobe; rectal examination revealed no prostatic tissue. A suprapubic operation was performed and a mass 4 cm. in diameter was removed. This had a dense fibrous capsule with glandular tissue in the center, that on section squirted out the milky secretion that is seen in prostatic tissue. My explanation is that a small portion of prostatic tissue became surrounded with connective tissue and started to grow, thereby causing the obstruction. No evidence of malignancy on section of either of these prostates was seen. Unfortunately the second case died four weeks after operation from angina pectoris. He was to have left the hospital in a few days, being able to void his urine through the normal channel. although the suprapubic wound was unhealed.

There is probably no operation in surgery that is productive to the patient of more happiness and comfort in the majority of cases than is a properly performed prostatectomy. But I want to emphasize the great importance of both the preoperative and post-operative care of these patients. A careful cystoscopic examination will reveal to the surgeon any complication, and

will often lead him to a different course of preoperative treatment than if this examination had not been made. It is possible to cystoscope 20 out of every 21 cases of prostatic hypertrophy. I feel convinced that it should always be done when possible, before any attempt at removal of the gland is made, for the reason I have just spoken of and for the great assistance it is in allowing a correct diagnosis of the intravesical prostate to be made, which cannot be made by rectal examination, thereby enabling the surgeon to choose the operation best suited to the individual case. I believe there is nothing that allows Young to publish his successful results from perineal prostatectomy more than the careful preoperative and post-operative treatment his cases get; and my only criticism of him is that he has not brought this point forward enough, as any ordinary man reading his work would conclude that it is the simplest operation in the world, and all the patients proceed to recovery without any after treatment at all.

INFILTRATION OF LINGUAL NERVE FOR OPERATIONS UPON THE TONGUE AND FOR RELIEF OF PAIN IN INOPERABLE CARCINOMA

By P. G. SKILLERN, Jr., M. D., Philadelphia
Assistant Instructor in Surgery and in Anatomy, University of Pennsylvania; Assistant Surgeon, Out-Patients, University Hospital

CONFRONTED with a lingual ulcer of eight months' duration and of questionable malignancy in a male patient 42 years of age, in which there was pyorrhœa alveolaris and slight roughness of the tooth upon which the ulcerated area rested, it was deemed expedient to excise a portion for microscopical examination, but the ulcer was so small (7 mm.) and unaccompanied by palpable lymph-node enlargement that total ablation seemed preferable. It was situated on the right side near the tip. If it were to be excised by the scalpel, the base would have to be seared with the actual cautery to prevent semination of possible cancer cells upon the raw surfaces, as well as to check hæmorrhage. This would require thorough local regional anæsthesia.

With the recent work upon peripheral nerve infiltrations fresh in mind, it occurred to the writer to infiltrate the right lingual nerve. This nerve can readily be felt, as it lies close to the bone beneath the wisdom tooth. A submucous injection at this site of 4 cc. of 2 per cent. novocaine and adrenalin 1:3000 induced anæsthesia in the distribution of the lingual nerve to the anterior two thirds of the tongue within five minutes. That the needle had entered the nerve was determined by immediate paræsthesia, and after this the injection was made.

The ulcer was removed by a V-shaped incision without any pain being felt. Its base was cauterized with the Paquelin cautery and all hæmorrhage arrested. The patient was naturally alarmed at the sight of the cautery so close to his face, and was nervous during its application, but felt no pain. He did complain slightly of referred pain in the ear, but this is not infrequent in peripheral irritation of the lingual nerve, and is explained by its connection with the auriculotemporal. The next day he said he had suffered no pain in the tongue since the operation.

Where can the lingual nerve be reached? It may be felt as a cord the size of a matchstick just internal to the pterygomandibular ligament, below and behind the last molar tooth, under the mucous membrane and close to the bone. Project a line from the last molar tooth to the angle of the mandible: the nerve crosses this line one half inch below and behind this tooth. In the aged and in others in whom the wisdom tooth has been shed, allowance must be made for absorption of the alveolar process. Infiltration of mandibular nerve is warranted only where growth destroys landmarks of lingual.

In painful neoplasms in the anterior two thirds of the tongue the suggestion has been made to divide the lingual nerve. In his book Mr. Butlin advises this. No nerve in the body regenerates so rapidly as the trifacial, and therefore resection of its branches is being abandoned in favor of alcoholic injection, as recommended by Patrick of Chicago. This method is equally applicable to chronic pain in the distribution of the lingual nerve.

After this article was written a case was met with by the author in which alcoholic injection of the lingual nerve seemed well indicated. It

was that of a male, aged 77, who, 3 months previously, noticed a small nodule near the tip of the tongue on the right side. This had increased in size by spreading along the lymphatics toward the base, until, at the time of examination, the anterior two thirds of the tongue, together with submaxillary lymph-nodes on both sides, were involved. Operation seemed scarcely justifiable, so that the right lingual nerve was infiltrated with 1 cc. of a solution of 2 per cent. novocaine and adrenalin 1:3000 in 4 cc. of 70 per cent alcohol. In about ten minutes there was complete anæsthesia of the right half of the tongue in its anterior two thirds. The following night the patient slept better than for two months and two days later a piece of the growth was painlessly removed for microscopical examination.

In alcoholic injections of nerves information is needed on a point that I have not seen raised. Are the defensive functions of sensory nerves seriously interfered with? For example, the tongue is the watchdog of the digestive tract, and objection to alcoholization of both lingual nerves might be based on the abolishment of tactile and temperature sense, it being conceivable that benign stricture of the œsophagus might arise from scalds that with the sensitive tongue would not have occurred. Sensibility of the lips, cheeks, palate and teeth, however, is unimpaired, and, with a word of caution to the patient, will prevent this accident. Therefore, it seems advantagecus to infiltrate the lingua! alone, instead of its parent stem, the mandibular, thereby preserving the sensibility of the lower lip, cheeks, and mandibular teeth via inferior dental. What transpires in this respect when Gasser's ganglion is ablated or alcoholized I do not know, but I am told that while pain sense is abolished, tactile and temperature sense soon return, at least in part. It must be that the degeneration of a nerve caused by alcoholization is not a true Wallerian degeneration. However, corneal ulcers are often sequelæ of ophthalmic nerve injury so that it behooves us to be careful in blocking the trigeminus or its branches injudiciously.

Infiltration of the lingual nerve, then, is the method of choice, because it is easier, less painful, and lasts longer after operation than direct regional anæsthesia of the tongue itself.

CONTINUOUS SUCTION, AND ITS APPLICATION IN POST-OPERATIVE TREATMENT

By JAMES H. KENYON, M. D. New York City

ABOUT six years ago we began using continuous suction in the operating room at the New York Hospital.[1] It proved so satisfactory that soon after its adoption in the operating room we began its employment in the wards and in the private rooms as an aid to post-operative treatment.

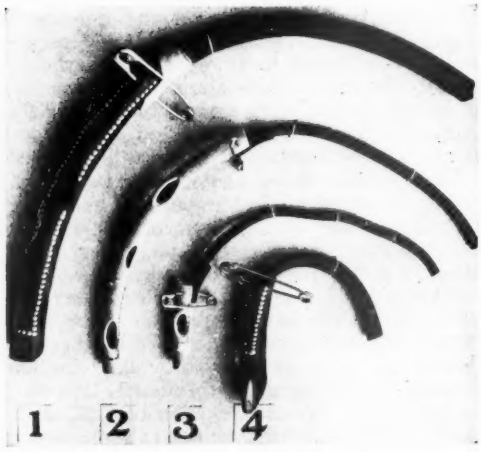
To obtain the necessary suction continuously and economically we have used an apparatus known in the chemical supply houses as a filter pump, and also a similar device known as a steam ejector. Water or steam flowing through either of these, with a pressure of 20 pounds or over, will produce sufficient suction.

We have the apparatus connected permanently with the water pipe in the wash room adjoining the ward, and a ¼-inch iron pipe is carried from it through the wall and along the base board, with a valve and hose connection opposite the first four beds. A stiff rubber tube connects this pipe to a two or a four quart bottle placed under the bed, and from the bottle another somewhat softer tube leads up to the patient.

This method of obtaining suction has many advantages over other devices, as it requires little or no attention beyond turning the water on or off, and it is not apt to get out of order.

The application of the suction tube to the region to be drained must be such that there will be no vacuum formed in the wound and no cupping action on the walls or bottom of the sinus. This result is obtained by using two tubes. The outer one, fenestrated and of a diameter and length to fit the sinus, is held in place by a stitch through it and the edge of the wound, or better, by a safety pin transfixing it near the edge and held against the skin by long narrow adhesive strips, a split gauze pad being placed between the skin and the pin. The inner tube must be smaller in diameter so as to permit free circulation of air

[1] "An Apparatus for Aspiration," by J. H. Kenyon and E. H. Pool, Surg., Gynec. & Obst., Dec., 1909, pp. 675–678.



Rubber tubes for continuous suction. Dotted lines show relation of inner tube to the outer tube. The inner tube is connected to the suction and is not fenestrated. 1, 2, 3 show snugly fitting rubber cuff on the inner tube. A safety pin through a projecting lip of this cuff and the side of the outer tube holds them both in their relation to each other. 4 shows both tubes transfixed with a safety pin, without the cuff.

between them and thus prevent a vacuum; it must not extend into the wound as far as the outer one by about half an inch, which result is obtained by a snug fitting, notched, rubber cuff, or a transfixing safety pin which rests on the top of the larger tube. This inner tube has only the end opening and is connected to the bottle under the bed.

Another and somewhat simpler method is to take a fenestrated tube suited in size and length to the sinus, place in it the smaller suction tube with its lower end about half an inch above the lower end of the outer tube, and then transfix them both with a safety pin. After sterilizing this double tube arrangement it is inserted into the sinus and held in place by long narrow adhesive strips.

This transfixing of the inner tube with a safety pin or stitch may give rise to leakage and a weakening of the suction, and is therefore not as desirable as the rubber cuff.

A shallow wound or a fæcal fistula, where one is endeavoring to hasten healing by strapping and does not wish to introduce a tube into the opening, may be satisfactorily drained and the surrounding skin protected from the irritating discharge by laying obliquely in the depression made by the approximating plaster a double tube, as described above, but very short, only one or two inches in length, held in place by adhesive plaster.

The varied applications of this method will readily suggest themselves. For example, any deep wound with difficult up-hill drainage where the patient is constantly suffering from wound absorption; all cases where the discharge is irritating to the surrounding skin, particularly fæcal fistulæ; pancreatic wounds; cases in which the discharge is very profuse and the patient made uncomfortable by being continually wet, or is annoyed by frequent dressings.

We have used the continuous suction with good results in draining extensive pelvic suppuration following peritonitis; in draining deep extraperitoneal pelvic suppuration following fractured pelvis and lacerated bladder; for suprapubic drainage after operations on the bladder, removal of new growths, removal of calculi, and prostatectomy. Perhaps the most satisfactory results have been noted in treating fæcal fistulæ, particularly those cases where the irritating discharge has produced a very painful and widespread eczematous condition of the abdominal skin, a few days of the continuous suction with a simple dressing generally being sufficient to clear up the skin condition.

As the case under treatment improves the suction may not be required all the time, but its intermittent use will be of benefit. Whenever wounds require irrigating, the application of the suction will render the process much cleaner.

INTRATRACHEAL ETHER ANÆSTHESIA

By ISAAC D. KRUSKAL, M. D., Brooklyn
Anæsthetist to the Jewish Hospital of Brooklyn

DURING the past year I have employed intratracheal insufflation anæsthesia with ether, using the Elsberg apparatus, in 84 cases in the ordinary routine hospital service. The most valuable feature of this method lies in the fact that we eliminate any possible anoxæmia from external respiratory obstruction, thus obtaining an even and sufficient narcosis and an even and sufficient oxygenation of the lungs.

The indications for intratracheal insufflation anæsthesia are thoracic surgery, the positive pressure eliminating the danger of pneumothorax when the plural cavity is opened.

It has not been my good fortune to have been able to employ this method in any case of thoracic surgery except in a number of cases of empyema and lung abscess. In cases of empyema this method permits of partial inflation of the lung, thus allowing the surgeon to ascertain if any adhesions are present in the pleural cavity.

In operations about the head, neck, oral and nasal cavities or where obstruction to breathing exists in the upper air passages:

In this field of work it has been most useful to both surgeon and anæsthetist. It keeps the anæsthetist out of the way and, therefore, permits more thorough asepsis of the operation field. The anæsthesia being constant a considerable amount of time is saved, with resultant advantage to the patient. In two cases of suboccipital decompression, for which the patient was placed flat on the abdomen, this method was of particular comfort.

In operations about the neck for which extension of the head is required, such as goiter and resection of glands of the neck where the posture would cause difficult breathing, this method eliminates all respiratory obstruction.

In operations about the oral and nasal cavities, the recurrent air stream prevents the aspiration of blood and mucus. Not only does this minimize the danger of aspiration pneumonia, but it also renders the field of operation free of any secretion, and, therefore, obviates any interruptions in operating.

In a number of cases of intestinal obstruction with fæcal vomiting the return current was very effective in preventing the aspiration of throat contents as the result of vomiting or regurgitation of stomach contents.

The quiet and even anæsthesia has popularized the method in upper abdominal surgery, such as gall-bladder work, and has made the task of the surgeon less difficult. Where the position of the patient makes the administration of an anæsthetic difficult or awkward, I have found this method particularly applicable. For this reason I have employed intratracheal anæsthesia in a number of cases of kidney and ureter surgery.

In feeble and debilitated patients, whose resistance has been lowered by age or disease, who have to submit to prolonged or difficult operations, this method of anæsthesia minimizes the operative shock. An insufficient supply of air or over-etherization is hardly possible with this method, and the fact that the patient has to make no effort in breathing relieves all strain on the cardiovascular system.

In my series of cases this method of anæsthesia has proven entirely satisfactory. I have found the method absolutely safe and no harmful consequences have resulted. If certain cardinal principles are adhered to, the method is a great deal safer in inexperienced hands than the ordinary methods of anæsthetization. Care must be taken not to introduce the tube beyond the bifurcation of the trachea, into one of the bronchi, the introduction of the tube into the œsophagus, or permitting continued overpressure.

The anæsthesia, as a rule, has been light, in fact in a number of my early cases the anæsthesia has been insufficient and in spite of careful manipulation, it was found impossible to cause complete abdominal relaxation to permit thorough exploration. In a few of the abdominal cases the intratracheal tube had to be withdrawn and the anæsthesia continued by one of the ordinary methods. After these experiences I instituted preliminary medication consisting of morphine $\frac{1}{8}$ or $\frac{1}{4}$ with or without atropine in all my cases of intratracheal insufflation anæsthesia, and have not encountered the same difficulties. The operations lasted from 15 minutes to 2 hours. Only a few of the patients complained of pharyngeal or laryngeal irritation as the result of the introduction of the catheter or its presence in these passages, and in none of my series did any pulmonary complications develop.

The pharyngeal irritation occurred in my early cases and was probably the result of my insuffi-

cient experience in the introduction of the tube. Injury to the teeth can be avoided by waiting for sufficient relaxation before attempting the introduction. Vomiting has been a great deal less after this form of anæsthesia and never did I see vomiting during the course of the anæsthesia. In my series, the patients showed less operative shock than is usual by the ordinary methods of anæthetization; particularly was this impressed upon me in a number of prolonged operations, such as resection of rectum for carcinoma.

In order to fully appreciate the advantages of this method, one must see a case of a plethoric, short necked adipose subject, brought into the operating room with collapsed ali nasi, partly cyanotic, labored breathing, with rattling of mucus in the throat, and then note the change that takes place after the introduction of the tube. The color becomes pink, the respirations quiet and easy, the pulse steady and of good quality, and the mucus is expelled by the return current.

TECHNIQUE OF ADMINISTRATION.

I have followed the method as advocated by Elsberg almost entirely.

The patient is first anæsthetized by any of the usual methods. It is essential that the patient be fairly well relaxed before the introduction of the tube is attempted. The mouth is then widely opened with a mouthgag and the head extended by an assistant. I have used the Jackson laryngoscope for the introduction and get a free exposure of the larynx. I have found that by proper extension of the head and by introducing the laryngoscope slightly from right to left, the larynx invariably comes into view. I have used the ordinary silk woven catheter size 22–26 French and I find that the introduction is facilitated by running the catheter through cold water; this renders the catheter more firm. Unless this is done, the warmth of the mouth and pharynx has a tendency to soften the catheter and direct it towards the œsophagus. When the tube enters the larynx, there is usually a characteristic hissing sound on expiration. This method of intubation has been highly satisfactory in my hands, but I suppose the manner of introducing the tube is a matter of individual skill and preference. Usually when the anæsthesia is light a troublesome cough follows after the ether vapor is turned on. This may be overcome by raising the pressure and increasing the strength of the ether vapor. With this apparatus the pressure is always under perfect control. I gradually raise the pressure to 20 mm. of Hg: with a pressure of 20 mm. of Hg, inspiration and expiration will continue, air being inhaled by the side of the tube. In my early cases I would interrupt the current of air and ether, which enters the tube a number of times a minute, but I have found that with a pressure of only 20 mm. of Hg it is not necessary to allow the lungs to deflate that often. In a number of cases at the request of the surgeon I have raised the pressure to 50 mm. of Hg without any ill effects. It has been my practice to turn the ether vapor on to 100 per cent (according to scale) at the beginning of the operation, and then to gradually reduce the amount of ether vapor to a point where a satisfactory narcosis was maintained. In most cases between 50 and 75 per cent of ether vapor (according to scale) was sufficient to maintain an even and smooth anæsthesia. The patients have never been too deeply under the anæsthetic and in no instance did I observe a dilatation of the pupils as an evidence of too deep anæsthesia. At the end of the operation I turn the ether off and allow air to insufflate; this hastens recovery from the anæsthesia and minimizes the post-anæsthetic nausea and vomiting.

SUMMARY OF CASES

Kidney and ureter	8
Head	12
Neck	9
Chest	8
Spine	1
Abdominal	40
Miscellaneous	6

CONCLUSIONS

1. The greatest field of usefulness of intratracheal insufflation anæsthesia is in thoracic surgery.

2. This method is of decided advantage in operations where the anæsthetist is in the way or the position of the patient makes the administration of an anæsthetic awkward.

3. In cases of obstruction to the upper air passages this method eliminates all the dangers of the ordinary methods of anæsthetization.

4. In the aged and feeble the relief of respiratory effort removes the strain on the cardiovascular system and thereby minimizes post-operative shock.

5. The return current of air prevents the inhalation of blood and mucus, — this renders operations about the mouth and nose less difficult, — and eliminates a decided factor in the production of aspiration pneumonia.

A SELF-RETAINING RETRACTOR FOR USE IN PERINEORRHAPHY

By LOUIS FRIEDMAN, M. D., New York City
Lecturer in Gynecology, N. Y. Policlinic Medical School and Hospital; Cystoscopist Harlem Hospital

TO obviate the necessity of retraction by means of bullet forceps or tenaculum held by assistants during plastic work on the vagina, this self-retaining retractor was constructed.

The two points corresponding to the position of the carunculæ myrtiformes or the remains of the hymen are caught up by the instrument as shown in the illustration, and by means of the screw the arms are separated to the extent desired, exposing thereby the field of operation, so obtaining a steady and equal traction on both sides. As the suturing is proceeded with, traction can be gradually decreased by a turn of the screw, bringing the arms closer together.

The instrument is light but strong, very simple, easily worked, readily adapts itself to the curve of the buttock so that it is out of the operator's way, takes the place of two hands which would otherwise be occupied in doing the retracting by means of bullet forceps, and gives a constant, steady exposition of the operative field.

In immediate repair of the pelvic floor following labor, where extra assistance as a rule is limited, this self-retaining device is very useful, particularly so where deep and high lacerations in the vagina must be attended to. It can also be used to advantage for retraction in cystocele plastic.

The instrument is 10.5 cm. (4 inches) long, has two curves, the arms separating to the width of 9 cm. (3½ inches), and has a firm bullet forceps catch at the end of each arm.

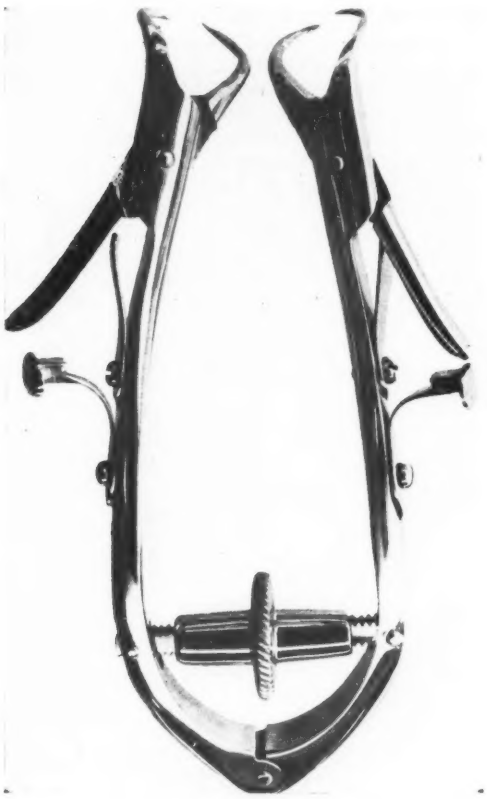


Fig. 1. Dr. Friedman's self-retaining perineorrhaphy retractor.

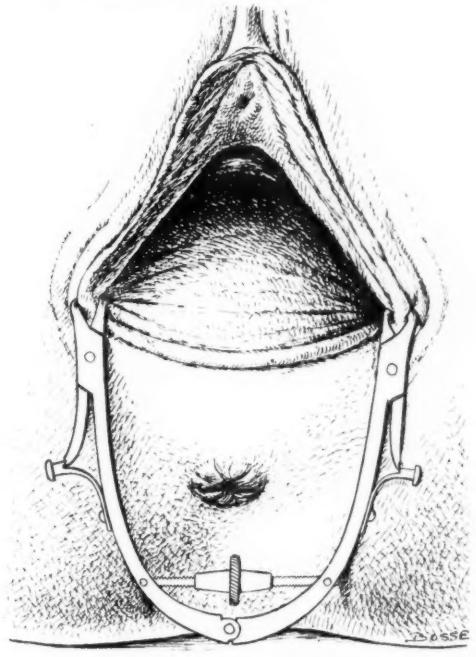


Fig. 2. The retractor applied and the arms separated.

A METHOD OF VENTROFIXATION COMBINED WITH CERTAIN TUBAL STERILIZATION BY MEANS OF EXTRA-ABDOMINAL DISPLACEMENT

By DeWITT STETTEN, M. D., New York City
Assistant Visiting Surgeon to the German Hospital; Instructor in Clinical Surgery in Columbia University

IT has been clearly proved by numerous experiments, especially those of Fränkel and Friedmann, that single or double ligation of the Fallopian tubes, even with division or resection, is insufficient to positively prevent a subsequent conception. Many clinical reports have corroborated these experimental results, and a large number of more or less complicated and reliable methods have been suggested for the purpose of guaranteeing a certain sterilization.

I have conceived the following plan of combining a simple but infallible method of tubal sterilization with a ventrofixation, where, as is generally admitted to-day, the prevention of a future pregnancy without castration is frequently indicated, particularly in the more advanced prolapse of yonnger women. A median laparotomy is performed and the round ligaments are ligated about two inches from the uterus. They are divided proximal to the ligatures and freed from the broad ligaments up to the uterine cornua by a few snips of the scissors. The peritoneal edges of the incisions in the broad ligaments are united by a running catgut suture. Ligatures are now passed through the broad ligaments between the tubes and ovaries, and the tubes are freed to their uterine attachment. The freed round ligaments and tubes are now brought through a stab wound of the fascia, muscle, and peritoneum on either side, three quarters of an inch away from the edge of the abdominal incision. They are drawn taut and fixed to the fascia with a catgut suture.

The peritoneum is closed with continuous catgut, one stitch passing through the fundus of the uterus, the surface of which has been scarified. The muscle and fascial layers are closed in the usual manner with interrupted chromic gut sutures. If one wishes to be extra certain of fixing the uterus, one or two of the fascial sutures could be passed through the fundus, the peritoneum being left open at this point.

The excess of tubes and round ligaments is removed and the tubes are ligated, the stumps being cauterized with a Paquelin. Enough of the tubes and ligaments should be left so that they overlap in the median line. They are stitched to the fascia and to the structures of the opposite side with a few sutures of catgut. The skin wound is closed completely. The various steps in the operation are clearly indicated in the accompanying diagram (Fig. 1).

This method of round ligament fixation is of course a modified Gilliam operation and is substantially the one advocated by McKay. Kelly has adopted the same principle for ventrosuspension, omitting the peritoneal uterine suture. It is not necessary here to dwell at length upon its many advantages. It is obviously more reliable than the old fixation methods of simply suturing the fundus to the abdominal wall, where, even if non-absorbable sutures are used, these can easily cut through if there is any tension, and all that holds the uterus in place is an easily stretched adhesion. In this operation, in addition to the peritoneal or even fascial adhesion, the round ligaments, derivatives of the uterus itself, become actually incorporated at their strongest portion, namely at the uterine cornu, into the fascial wall of the abdomen. The division of the ligaments prevents the formation of lateral intra-abdominal foramina, and the peritoneal or fascial stitch to the fundus, besides reinforcing the fixation, prevents the formation of a foramen between the two ligaments. I have used the simple fixation in a number of cases and it has always proved satisfactory.

The new feature which I am advocating here, namely, the drawing of the tubes through the stab wound, has a twofold object. First, it reinforces the round ligament fixation, so that practically the uterine cornua themselves become attached to the abdominal fascia, and much the same purpose is accomplished as by Kocher's exohysteropexy without the complexity of this latter operation and without disturbing the anatomy of the anterior abdominal wall. Second, the lodgment of the distal ends of the tubes outside of the abdominal cavity is an absolutely certain guarantee against conception. Obviously, the operation can only be applied to cases in which the tubes are not seriously diseased.

After having performed this combined fixation with sterilization, I discovered that Blietz in 1901 reported on a procedure the underlying principle of which is somewhat similar. He describes an

operation for tubal sterilization carried out by Menge and Krönig in which the ends of the tubes are anchored outside of the abdominal cavity through two inguinal incisions, either independent of or combined with an Alexander-Adams ventrosuspension. Aside from the disadvantage of bilateral incisions, I feel that in prolapse, where a permanent fixation is desired, the method that I have described is, for obvious reasons, greatly to be preferred.

As yet I have performed this combined operation in but one case. The patient made a most uneventful recovery and the wound healed by first intention. The scar is solid and the uterus is firmly anchored to the abdominal wall. There has been no pain and menstruation has caused no disturbance.

It has been suggested to me that an infection of the tubes may give trouble. In answer to this argument, I can simply say that I would prefer dealing with a subcutaneous pyosalpinx than with an intra-abdominal one, and I am convinced that the patient would also. The possibility of a tubocutaneous fistula or a hydrosalpinx developing as a result of this extra-abdominal displacement of the tubes can, I think, be disregarded.

It is even conceivable that this method of tubal displacement, with or without the round ligament operation, might be used for the purpose of producing a temporary sterility. Should for any reason a subsequent pregnancy be indicated the tubes could be replaced into the abdomen. The fimbriated extremity could have been left, and even a ligature of the tubes could have been dispensed with at the primary operation, if this eventuality was to be anticipated. If the tube has been ligated, if the fimbriated end has been amputated, or if the tube has become occluded, a plastic operation might be attempted to restore the lumen.

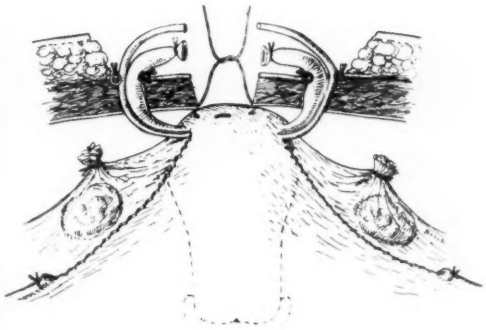


Fig. 1.

TRANSACTIONS OF SOCIETIES

CHICAGO SURGICAL SOCIETY

REGULAR MEETING HELD JANUARY 10, 1913, WITH THE PRESIDENT, DR. CHARLES DAVISON, IN THE CHAIR

DR. PAUL B. MAGNUSON read a paper entitled "Lengthening Shortened Bones of the Leg by Operation." (See p. 63.)

DISCUSSION

DR. E. WYLLYS ANDREWS: We ought to express our appreciation of this rather valuable and original contribution. I am sure that every one of us will be interested to learn that we have an animal substitute for metallic foreign bodies in bone work just as we have it in catgut or kangaroo tendon for soft parts, something that is better than wire, silk or linen. The writer of the paper through his research, first on animals and then by his later application in operative work, has introduced to a certain extent a new principle. I have been wondering what method of sterilizing ivory was used. I have always looked upon this matter of extending or the lengthening of bones as a sort of bugbear. In all the bone work I have ever done, I have not been able to lengthen the bone in an old fracture which had shortened a few inches, except by extreme force or free cutting. I have not usually been able with several hundred pounds traction with two or three strong men, to pull out a shortened limb quickly. One of my colleagues invented the toggle-joint principle in doing this. Supposing it were the femur, and shortened a couple of inches, the toggle-joint principle gives a tremendous leverage. It is the principle upon which the printing press works. We cut down upon the overlapping fragments. If we angulate sharply as if we were going to resect the ends, these fragments come apart and can be placed together end to end while bent. If one takes the power of leverage by straightening he brings to bear a perfectly enormous pressure or tension or extension-pressure on the ends, on the toggle-joint principle, and in this way the limb can be lengthened in a way in which it could not be by the pull of two or three strong assistants making extension and counterextension. I am interested to know that even in the human subject three inches of extension can be gotten with a sixty-pound weight. I have not been able to get half an inch of extension when I have cut down upon an old fracture, say three or four weeks old, except by long, hard stretching. I have had a dread of these cases and have planned a different method, cutting through the soft parts where they would be released, at the same time important nerves and vessels not be injured. Perhaps Dr. Magnuson can tell us how one can thoroughly sterilize these pins. The late Dr. Nicholas Senn performed the operation of fixing a fracture of the neck of the femur with an ivory peg. I do not remember whether in any of his reports he related how he sterilized the peg, or whether he had to take the peg out or had it disappear by absorption.

DR. WILLIAM HESSERT: I unfortunately was not in the room when Dr. Magnuson demonstrated the extension apparatus, and I have had no experience with this apparatus. I have had considerable experience with the Miller-Lemon apparatus, which I like better the more I see of it. This apparatus enables one to operate on fresh cases and old cases with faulty union and a great deal of overlapping, like these pictures of the femur the doctor showed. From my experience with this apparatus, I cannot conceive of any other appliance that will accomplish the same end results. You can get an enormous amount of traction, as was illustrated in a case that Dr. Harris and myself operated about ten days ago. A man came into the Alexian Brothers Hospital with a compound fracture of both bones of the forearm and a simple supracondylar fracture of the femur. The man developed a case of delirium tremens, and his life was despaired of for a while, so when he got so we could do something for his fractures there was considerable deformity. He got union of the femur with three inches of shortening from overriding. Dr. Harris operated and used my apparatus. We were able to get the

fragments, which were united, absolutely solid, in good position, after breaking up the union. The ends were brought in very fine apposition and hold there with a Lane plate. I am sure there was a lengthening of three inches without any disturbance to the nerves or disturbance of the circulation. I doubt whether an apparatus of the kind shown by Dr. Magnuson would exert a sufficient pressure or pull to bring the fragments of such a case in line.

About the use of ivory screws, I am a bit skeptical. I do not think an ivory screw will hold very much where there is great tension required. It is a good thing, I have no doubt, but a metal screw is a good thing when sterilized. It all depends upon the asepsis. If an ivory screw is not aseptic when it is put in, it is going to act like a sequestrum or a foreign body, with the formation of serum or pus, or the formation of a sinus within six or eight weeks. It is a matter of asepsis. If the screw is aseptic, it will remain more or less in place, although it will cause necrosis surrounding it. But the main point is asepsis. If it is clean it will stay in; otherwise it is going to come out, whether it is a screw, catgut, or kangaroo tendon.

Dr. Arthur Dean Bevan: I want to say a word or two with reference to this apparatus. It has an interesting history. It was the Ridlon apparatus long before Lemon made the apparatus, and it has the following history: Some years ago a layman in Boston—I think his name was Bartlett—working with Bradford on dislocations of the hip invented an apparatus for the reduction and dislocation of the hip. That was taken up by Dr. Ridlon, and Dr. Ridlon developed from that a very admirable apparatus of which there are a number in the city of Chicago. Dr. Lemon then saw the Ridlon apparatus and modified it. As a matter of fact, the present apparatus which he used for extension belongs to Dr. Ridlon, so far as applying it to fractures is concerned. Ridlon has a very admirable apparatus. I think there are at least three in the city. I get this straight from Dr. Ridlon himself. Recently a meeting was held here of the Orthopedic Society of the Middle West at which the apparatus was shown and this history given. I think we should give credit to our local fellows when they deserve it.

Dr. Jacob Frank: I want to express my appreciation and pleasure in having listened to Dr. Magnuson's paper and the very fine work he has brought before us this evening. The work on dogs does not prove that it can be done on the human as easily as it can be done on the animal. I understand, from the pictures, the bone was removed and was merely replaced by another piece of bone, and that the normal leg was stretched beyond its normal length. It is quite a different proposition stretching pathological tissue.

Dr. Magnuson: It was. There was no bone removed, but just cut and stretched.

Dr. Frank: It is rather strange that the doctor did not do some injury to the nerves or vessels in some of the dogs. In the human we have got to determine, first, what is a recent and what is an ancient fracture. If you have a fracture of two years' standing, which overlaps two inches or more, I doubt whether it can be replaced as easily as has been demonstrated here. Then another thing: badly united fractures of the humerus, forearm or leg are more difficult to reduce than a fracture of the femur. My experience has been that a fracture of the femur can be reduced easily without any stretching apparatus, especially by the method that Dr. Andrews has described and which Mr. Lane uses, by bringing the proximal and distal ends of the bone in contact, forming an inverted V; the thigh is then straightened, keeping the bones in contact. For some reason this cannot be done as easily with the humerus. While I was in Philadelphia attending the North American Clinical Congress, I remember seeing Dr. Martin use an apparatus with which he tried to pull a badly united fracture of the humerus into place. He tried for at least three quarters of an hour, after loosening the fragments, and failed. He kept stretching until he was afraid of doing harm to the vessels and nerves, and discontinued the use of the apparatus. He demonstrated to the audience that if one exerted too much force it would have a bad effect upon the patient's general condition. He gave up the reduction with the apparatus and simply sawed off the ends of the bone and united them with a Lane plate. Take an ununited fracture, where there is a loss of bone from a gunshot wound, and where there are two or three inches of the bone gone, and the muscles have pulled the ends of the bone together, and it has been in that condition for a year or two, I am positive it cannot be lengthened without doing harm to the vessels and nerves. Can we lengthen the muscles, nerves, and vessels two or three inches if the patient has been in that condition for a year or two? I do not think so. I have failed in reducing by pulley and tackle a dislocation of the elbow of five months' standing. Force enough was used until I thought I would pull the patient's arm off, without any results. I merely cite this to illustrate how difficult it is to lengthen tissues that have become contracted. These

muscles could not be stretched after five months. It seems easy, but it is not easily done. Why is the reduction of the femur simpler to reduce than that of the humerus or leg? I have observed this, but cannot give any satisfactory explanation, as the tissues surrounding the bones of the leg and arm are certainly of smaller size than those of the thigh.

With reference to the use of ivory pegs, we all know they have been tried and discarded, and that is one of the reasons why the Lane plate came into use. It seems to me it does not matter much whether ivory pegs are made in screw fashion or not, the ultimate result would probably be the same.

DR. MAGNUSON (closing the discussion): I did not for a minute mean to compare this crude arrangement with the arrangement that Drs. Bevan and Hessert spoke of. Those were real stretching apparatuses, while this is simply an imitation. This simply consists of a suspender that holds up the pulley and takes what is called a clove hitch around the knee. It has a knot which does not pull tight, but does not shut off blood supply, but catches above the patella, and this answers the purpose very well in the cases I have reported. I have used it several times for other men successfully. Dr. Richter had a case not long ago that we pulled down a couple of inches. He had two cases.

DR. ANDREWS: What bone?

DR. MAGNUSON: The femur. Dr. Plummer's was nine months, with three inches of shortening. I used sixty-five pounds on the fourteen-year-old boy. This apparatus is practically the same thing that Dr. Martin uses except he puts towels and pads around the ends of the fragments.

DR. ANDREWS: How much force or pressure did you use on adults?

DR. MAGNUSON: I used from eighty-five to one hundred pounds and a steady pull seems to bring the muscles down.

DR. WILLIAM FULLER: How long a pull?

DR. MAGNUSON: Until we get what we are looking for.

DR. FULLER: How long does it take?

DR. MAGNUSON: About ten minutes.

DR. HESSERT: How do you judge the amount of traction?

DR. MAGNUSON: You use window weights, and hang the window weights on with hooks, keeping track of the pulsation of the tibial artery, noticing the condition of the circulation and the condition of the patient, and so far I have not noticed any bad result from pulling. I do not compare this apparatus with the Ridlon, because it is undoubtedly the best apparatus of the kind I ever saw. You can pull a hip right out of the socket or pull the leg right off with it. This arrangement I got up to meet an emergency which is used in our experimental work, and Dr. Martin afterwards started using it in the University Hospital, and it worked very well. One of my principal jobs as an interne in the University Hospital was hanging on to the foot, trying to pull out the femur, and as necessity is the mother of invention, I got this thing up to save a little work.

DR. FRANK: You have seen Dr. Martin work. Did you ever see him fail?

DR. MAGNUSON: Oh, yes. As to sterilizing these ivory screws, we cannot boil them because they warp. I put them in a saturated solution of alcohol and bichloride, put them into the autoclave, and sterilize them for an hour in the autoclave with alcohol.

Of course, in operating on a fracture we have a different proposition than stretching the leg out where you have a longitudinal incision with nothing to take the strain off the muscles. By this operation you simply have a longitudinal incision, with a cross incision at each end. All strain comes on the screws. Every bit of the muscular strain is held by the screws running through the bone. In a fracture, when you get the ends of the bone together, the screw holds it together. When you are going into bone and pulling the ends apart the strain comes on the screws.

CHICAGO GYNECOLOGICAL SOCIETY

A Clinical Meeting was held at Rush Medical College, January 17, 1913, with the President, Dr. Rudolph W. Holmes, in the Chair

Dr. Carl G. Davis read a paper entitled "Review of the Literature and Case Reports of Ruptured Uterus." (See p. 51.)

DISCUSSION

Dr. N. S. Heaney: The only thing in Dr. Davis' paper that I do not agree with is his advice that after a patient has had one Cæsarean section, she should be delivered by version and extraction in case she goes into labor. It does not matter whether the woman is at term or in labor, the preferable procedure is to do a section unless the section is contra-indicated by a too advanced progress of birth when first seen.

Another suggestion that occurred to me because of the emphasis placed on ergot as an etiological factor in rupture of the uterus, due to the tetanic contractions from its administration, is that I feel sure that in the near future we will hear of cases of rupture of the uterus produced by pituitirin. In the early reports of the use of pituitirin, it was stated that the contractions produced by it were rhythmic, and not tetanic; but recently we have begun to get reports of adverse conditions produced by the inadvised administration of pituitirin, and it has been conclusively demonstrated by the use of a bag inside the uterine canal connected to a recording device that these contractions are not rhythmic, but are tetanic, and that oftentimes the primary contractions will last from fifteen to twenty minutes. The indications for the administration of pituitirin have not been carefully studied, and it is given to too many cases where labor is protracted for other reasons than uterine weakness. Just recently some are beginning to emphasize the point that pituitirin should not be given in cases where there is a dsytocia, or given in the first stage of labor, but preferably in this stage the patient should be rested instead of the labor pains strengthened by the administration of pituitirin.

Dr. Frank W. Lynch: It seems to me that the man who attempts to excise the scar from a Cæsarean section will frequently get into trouble. I have had the opportunity of doing secondary sections in four or five cases, and in two of these we studied the scar following the Cæsarean section. The scar in two of the cases practically disappeared, so that there was only a faint broken line of connective tissue. I am quite sure that is what will happen if the case has gone on for a year or two before a second pregnancy ensues. It is true, we are to be guided by the site of the scar from adhesions, which are the invariable result, but it is surprising in some cases how faint the adhesions will be if it has been three or four or more years since the first section. I feel there is very little doubt but that the literature shows us that once a case is treated by Cæsarean section, it should again be so treated. There is no doubt that the great majority of these cases have ruptured from dystocia, largely due to the fact that before the last few years the second test of labor has been desirable, or thought to be desirable, to prove the value or nature of the indication for a cutting operation.

I agree with Dr. Heaney that if version is attempted you subject the woman to the greatest possible risk not only from rupture of the scar or rupture in the weakened area, but from infection when the woman is late in labor, and who has had the membranes ruptured, with probably the amniotic fluid drained away, as would be expected if there was a primary indication for the Cæsarean operation.

Dr. Mark T. Goldstine: I was glad to hear a report of these cases of rupture of the uterus. With reference to the conservative and active treatment of rupture of the uterus, I think active treatment is better. It should be the one resorted to. In the cases of rupture of the uterus I have watched treated by others, and that I treated myself under instructions, I recall a few of them in which yard after yard of gauze was packed into a supposed rupture of the uterus, the gauze being packed into the peritoneal cavity, and I am firmly convinced did not do well.

A few years ago I reported a case before this society of complete rupture of the uterus (and the specimen is here in Rush Medical College) in which the baby and placenta were delivered in the peritoneal cavity, in which I did a radical operation, removed the uterus, and the patient is living to-day. I had four other cases that were treated conservatively, and all died. I am positive two of those cases that were treated conservatively might have had better results if treated radically.

A great many ruptures of the uterus in the past have been unnoticed. I recall one case of

rupture of the uterus, but how it occurred I do not know. There was no instrumental work done afterwards, but a laparotomy done two months afterwards showed a rupture in the fundus of the uterus covered over where the omentum was adherent to it.

In regard to the cause of rupture of the uterus, clinically I do not think many of these ruptures occur spontaneously in tonic contraction. I have seen many uteri tonically contracted in concealed accidental hæmorrhage. I never saw a uterus rupture that was distended with hydramnios—not that I advocate giving ergot or any other drug to cause tonic contraction. I have gone so far as to say that we should never give ergot in premature detachment of the placenta, but I do not feel convinced that the uterus ruptures spontaneously when it is tonically contracted. You must have rhythmically strong contractions.

I saw one case of spontaneous rupture of the uterus in a multipara with complete rupture into the peritoneal cavity, in which the patient was still in the first stage of labor, and the cervix would only admit two fingers. A large tear was found; the baby was of average size, and the membranes were ruptured. Her uterus was not tonically contracted.

It is very hard to get reliable statistics on rupture of the uterus, because a good many of the cases are not reported, not even the spontaneous ruptures.

Dr. W. A. Newman Dorland: The paper read by Dr. Davis is one of great interest, not only from a statistical point of view, but from a clinical standpoint. The cases reported were all desperate ones, and there was nothing to do but to attempt to save life.

I was interested in the treatment of this condition as the result of a case which came into my service at the Philadelphia hospital, a case of cross-birth, in which I permitted the interne, at his request, to do a version. As he extracted the head there occurred a tremendous hæmorrhage. I took the case in hand, and on making an examination found a complete laceration on the left side of the lower segment of the uterus, through which I could feel the intestines. I tamponed the cavity and opening and did an immediate abdominal section. I found a tear, probably four inches in length in its contracted form, which I closed in a conservative manner, by a running suture of catgut, and had an excellent result. The patient recovered. At that time I investigated all of the cases in the literature for the two years preceding, 50 cases in all, and I compared the radical with the so-called conservative or expectant plan of treatment, with the results as given by Dr. Davis in favor of the radical operation. I believe that version is a natural menace in many of these cases. The impaction of the child's head through the contracted cervix is apt to cause a laceration of the lower segment. In my case the laceration was of the lower uterine segment, extending obliquely up to the upper segment.

The treatment by tampon and expectancy, I think, should be mentioned only to be condemned. I am not sure but that every case of tear should require a total extirpation of the uterus, but that would depend largely upon the conditions found. If possible, I think the uterus should be saved. I agree with the suggestion that after a tear, it is safer to follow in a subsequent labor with Cæsarean section, in cases that can be closely watched.

Dr. Rachelle S. Yarros: The thing which interests me in the recital of these cases of rupture of the uterus is the obstetrical aspect of them. In my experience in connection with dispensary and hospital work, carried on for the purpose of teaching students, which would include probably nearly four thousand cases. I can only recall two cases of rupture of the uterus. The first one, a multipara with two previous normal labors, but the history of a lacerated cervix. Shoulder presentation unrecognized by interne and students for an hour after membrane ruptured. Version was performed with little difficulty, and the living child extracted. A severe hæmorrhage followed and the patient collapsed. Dr. C. J. Webster saw the case with me very shortly after and confirmed the diagnosis of rupture of the uterus, extending from the cervix deep into the body. He advised packing, and the woman made a splendid recovery. Six months later, I could not find any trace of the rupture: the cervix was badly lacerated. She subsequently gave birth to two children. We watched her carefully during the entire pregnancy: the children were small and the labors normal. It seems to me that it would have been a mistake of judgment to perform a Cæsarean section in such a case, since the rupture was due to malposition and neglect.

The second case was one that occurred during packing of the uterus for hæmorrhage, due to atony. As the gauze was being pushed in, the doctor said that he felt a sudden giving way of the uterus. On examination a deep tear, extending from the cervix into the body of the uterus, was found. The severe hæmorrhage which followed could not be controlled by packing. The woman was in a desperate condition, but as soon as the

rent was sewed up the hæmorrhage ceased and the woman gradually recovered. It seems to me that in dispensary and hospital work, which is carried on for the instruction of the student, whose efforts at diagnosing the position and presentation are made early, and where cases are watched by students and internes who have no other demand on their time, cases of rupture are less likely to occur than the work of midwives or private physicians who practice obstetrics as an incidental matter, and with whom time counts for too much, and effort for a definite diagnosis is seldom made.

DR. J. CLARENCE WEBSTER: I am very much interested in the question of rupture of the uterus following Cæsarean section. Did I understand you to say, Dr. Davis, this case of Dr. Culbertson's was one in which I did Cæsarean section years ago?

DR. DAVIS: Yes.

DR. WEBSTER: But the rupture began about the cervix.

DR. DAVIS: The tear extends down across the cervix and from the fundal end of the scar.

DR. WEBSTER: On the anterior or posterior wall?

DR. DAVIS: On the anterior.

DR. WEBSTER: Can you see the old incision?

DR. DAVIS: Yes.

DR. WEBSTER: I have a specimen of a non-pregnant uterus which I removed for pelvic disease some years after I performed Cæsarean section, and all that can be seen of the former scar is a little white line about half an inch long. The wall of the uterus is absolutely normal, and just as thick in front as behind. It is interesting to compare the thin wall of the pregnant uterus with the thick retracted wall found after the fœtus and placenta. If the stitches were applied to the former, no change occurring in the wall, it would not be surprising to find a weak scar after the operation. However, the thickness of the wall which is stitched amounts to an inch or more, and there is a broad area of approximation. In the reduction of the uterus to its normal size there must be a considerable change in the relationship of muscular bundles and fibrous tissue. The original four or five inch incision is marked by a scar one half or three quarters of an inch in length, and this portion of the wall should be as strong as any other.

I believe that the great mass of statistics of rupture of the uterus following Cæsarean section belong to the older period of careless sewing and the non-use of catgut so as to get a broad approximation. If there is a gap left in the uterine wall and pregnancy occurs, the risk of rupture will be great. Sometimes the stitches may cut through the soft musculature or there may be premature absorption of the catgut, so that only peritoneal union may be obtained. I would not take the radical position which Dr. Davis and Dr. Lynch have taken, that once a Cæsarean section, always a Cæsarean section. I believe a wiser position would be to say, once bony dystocia, always a Cæsarean section. But if I operated on a woman for some cause, as for placenta prævia, or an ovarian tumor, I would watch her carefully and carry her, at least, through the first stage of labor, delivering her with forceps, when the head had descended a certain extent. I believe that would be a more conservative procedure than to advocate Cæsarean section for every case in which the operation had previously been carried out. Of course, a case in which section had been performed might require the operation again for some cause which did not exist at the first procedure.

DR. FRANK W. LYNCH: In my previous remarks I meant dystocia. In thinking over the cases in the past, placenta prævia was not an accepted indication, although it is made so now by the recent work of the Berlin School, showing implantation in the cervix, where primary Cæsarean section was the method of treatment. A great many of these cases had been tided over to the second stage. If there was some accidental condition, Cæsarean section should be performed, and in a subsequent pregnancy, if the child was of small size, I would wait. But I do feel that in the cases reported Cæsarean section was indicated.

DR. J. CLARENCE WEBSTER: It is a very different matter where a rupture of the uterus occurs outside the hospital in the hands of incompetent attendants. In the hospital facilities exist for immediate surgical interference, and patients need not suffer from loss of blood due to neglect or delay. Every case of labor in which Cæsarean section had been previously employed should be attended in hospital, the operating room being in readiness for an abdominal section if rupture should occur. Under these circumstances the risks would be reduced to a minimum, so that we might feel more strongly supported in urging that expectant care in labor should be observed, rather than immediate Cæsarean section, unless there is a very positive indication.

DR. RUDOLPH W. HOLMES: Some time ago I reported a case in which I had performed a Cæsarean section, indicated by a rupture of the uterus in the previous labor. About two years

previous to the section I was called to a case at the Augustana hospital, in the hands of an outside physician; in the meanwhile the family had called in another obstetrician. On my arrival, the latter already had the abdomen opened. There was a transverse fundal rupture which the operator sewed up. Rupture had occurred in the last expulsive pain, for the labor was spontaneous, or else attempts at manual placental removal had done the damage — the placenta was lying loosely in the abdominal cavity. The woman almost died from a double pneumonia, but finally fully regained her health. On her return to the hospital in her next pregnancy, I advised and executed the section on account of the previous repaired rupture. On inspecting the old scar there was a softening, dimpling, at the right extremity of the scar. It is logical to believe the dimpling and softening at this point would be a vulnerable point, and probably would give way under the stress of labor.

Many causes have been assigned for the production of rupture of the uterus, but the fundamental one is the ignorance and carelessness of the attendant. One rarely reads of rupture in the hands of the obstetric expert: the cases he has are those brought to the hospital for emergency relief; obstetric prophylaxis has nearly wiped out the existence of this complication as a primary one, in obstetric clinics. This is a question more of the failure to recognize hydrocephalus, minor pelvic contractions, malpositions, etc. I believe Schroeder was right in enunciating the general rule that version was contra-indicated two hours after the membranes were ruptured. This limitation requires some qualification; one woman may have a premature rupture of the membranes with a quiescent uterus for twenty-four hours in which event the version may be more safely done than in another case with a violently acting uterus, scanty water, and the membranes intact, at the time of operation. Fundamentally it is merely a question of the retraction and contraction of the uterus. Further, I believe it is an obstetric anachronism, to put it mildly, to do a version on a dead baby when retraction of the uterus offers the slightest hindrance. There is too much dread among too many physicians to the craniotomies and embryotomies on dead babies, oftentimes these operations are infinitely safer than unscientific versions, brutal prolonged high forceps. I have always felt that Cæsarean section once means Cæsarean section always. Ninety-five per cent of Cæsareans are performed on pelvic indications; therefore, in these the indication is always present; here we do not have extraneous matters to debate. But, if a woman came to me with a history of a Cæsarean for placenta prævia, eclampsia, or ovarian cyst, I would hesitate a long time before I would allow her to subject herself to the large potential risks of a rupture with the catastrophe facing her and the baby.

Dr. Webster has struck the very keynote in arguing the question. Who knows the technique of the man who performed the previous section? If it were done personally, who knows how durable the catgut was, and how active was the phagycytosis at the line of incision? If one stitch fails, it may mean a marked diminution in the integrity of the whole suture — a gaping occurs — at this point rupture occurs in the next labor. Recently I removed a catgut stitch from the vagina in a woman who had an anterior colporrhaphy performed by me two years ago; apparently there was no attempt by nature to remove this catgut. On the other hand, how often does catgut dissolve too quickly.

The essayist states that I had delivered one of his cases through the natural channel after a Cæsarean; unfortunately I do not recall (nor can I find her record) at the moment of doing this. If so, I may have been ignorant of the fact of her previous history on this point.

I believe the most logical treatment for this complication, complete or incomplete, may be epitomized as follows: *Child in uterus:* Head in pelvis, child alive, forceps; dead, then craniotomy; transverse presentation, decapitation. If child is in the abdominal cavity, partially or wholly, then immediate laparotomy. If placenta is in utero remove it manually; if in the abdomen leave until the abdomen is opened, then remove it. If the rupture is a clean-cut one and small, sew up; if extensive, hysterectomy. The operative course is the best for the abdominal surgeon; on the other hand, the tamponade offers the best course to him who has not hospital facilities at hand and is not versed in abdominal surgery.

Dr. Yarros expressed herself as jamming in the gauze as tightly as possible. I think that is a mistake. I had one case of atony of the uterus in which I as tightly as possible tamponed the utero-vaginal tract. She had persistent bleeding, and nearly died, in spite of the tamponade. Bleeding stopped as soon as the gauze was removed. The overdistention of the uterus prevented retraction, and therefore promoted hæmorrhage. I have never heard of this danger, and have never seen it in print, but overdistention is dangerous. To jam in gauze in a rupture

may mean an extension of the tear, so the work should be done carefully.

DR. GEORGE SCHMAUCH: With regard to scars, referred to by Dr. Webster, he probably knows as well as I do that there have been many cases of Cæsarean section performed without sewing the uterus at all, and without getting any trouble. When surgeons started to avoid infection they did so by suturing the uterus with catgut in several layers. Most of the cases of rupture of the uterus after Cæsarean section have shown excessive formation of fibrous tissue in the scar, and in many of them there was an excessive invasion or formation from the decidua cells in the scar. These things are absolutely naught in the hands of the operator. It is more the fault of the organism of the woman that brings about these conditions. You cannot blame catgut or the man who has operated on them.

DR. ALBERT GOLDSPOHN: The remarks of the last speaker call to my mind a little argument which I put forth years ago on an entirely different subject, namely, that it is not in the power of the operator to determine how strong a ligament he will make when he does ventrofixation of the uterus, as in days gone by. If the ligature is unduly tight, it will cut off circulation; you will not get union, no matter how much tissue you tie or sew together. If the ligature is absorbed prematurely, that is not in his power or knowledge to control. If the ligature is not perfectly aseptic, or the technique of putting it in is not aseptic, so that slight infection enters, there will be a local emigration of round cells which end in connective tissue and the formation of scar tissue, fibrous tissue, inelastic formation, instead of the normally thick layer of uterine wall that Dr. Webster presupposes is the natural outcome. There are such chances that are scarcely in any operator's control which may happen and invite rupture. In that respect, I cannot exactly agree with Dr. Webster's reasoning.

DR. DAVIS (closing the discussion): In connection with the question of version without rupture and without Cæsarean section, Stroganoff takes that up in his article and states that there has been too much stress laid upon the danger of version. He searched through the records of the cases of rupture and found that version was a very rare factor in the causation of rupture. If you are going to consider version without your obstetric teaching, then it should not be attempted; then it becomes a danger, but a version performed early, when it is considered good obstetrics, should not cause very many ruptures. I aimed to be understood with Dr. Webster that if a case came into the second stage, and there was not a question of dystocia, it would be a very easy matter to deliver by version or forceps, whichever one was considered best for that individual case.

In connection with the scar, if you are going to attempt to remove the scar, as Dr. Lynch suggested in performing a second section, it would be necessary to make your incision at some distance from the scar to avoid this narrow strip of muscle fibre which probably would not be strong and would be an increased danger in subsequent pregnancies.

EXHIBITION OF SPECIMENS

DR. E. R. LECOUNT demonstrated (1) a small ovarian cyst, removed by Dr. Dudley at St. Luke's Hospital, Chicago, in which the cyst wall had become converted into true bone with Haversian canals and minute marrow cavities. He referred briefly to other processes of metaplastic bone formation and emphasized the relationship of hæmorrhage to the processes. In this ovarian cyst there were no depots of red blood corpuscle manufacture in the marrow. They have been found in numerous examples of metaplastic bone marrow. The experimental production of bone by processes of metaplasia is readily obtained in the pelvis of the rabbit's kidney by ligating the renal artery. It has also been produced in large arteries by painting the wall of the vessel with silver nitrate.

(2) A large ectopic pregnancy, also removed by Dr. Dudley at St. Luke's Hospital. This large ectopic pregnancy, gestation having gone on to the end of the eleventh month, was removed without rupture of the sac at any point. After fixation in museum fluids the sac was opened by an encircling incision in the middle, and the fœtus taken out, when the two halves of the sac maintained their shape much like the halves of a cocoanut-shell when it is cut open. The patient is still living. The pregnancy, of course, is a tubal pregnancy.

(3) Two examples of cyclops. In connection with these malformations, reference was made to the necessity of early, thorough embalming in order to make the material available for study of the main problems still connected with malformations. The brain of one of these examples of cyclops has been most carefully examined under the direction of Professor C. Judson Herrick of the University of Chicago. As a result most interesting developments will shortly be published. The other cyclops has not yet been opened.

(4) An example of hernia of the proximal one half of the small bowel into a large duodenojejunal pouch. This specimen was fresh, being removed on the day of demonstration.

REPORTS OF CASES AND DEMONSTRATION OF SPECIMENS

DR. J. CLARENCE WEBSTER: 1. Pregnancy in the right horn of a bicornuate uterus, together with a single large extraperitoneal cyst situated between the vagina and rectum.

The patient was a married woman, aged 31. She was admitted to the Presbyterian Hospital on November 30, 1913, complaining of amenorrhœa since August 12th, morning sickness for two months, increase in size of the breasts with tenderness, and abdominal enlargement. On examination a swelling was found in the right lower abdominal quadrant resembling a four-months' pregnancy. On the left of this swelling was another, firmer in character, about the size of a two-months' pregnant uterus, connected with the lower part of the larger swelling. The cervix was normal in size, though somewhat softened. The pelvic cavity was almost entirely occupied by another swelling, tense and elastic in character, which bulged the posterior vaginal wall downward and the cervix and bladder forward and upward. An abdominal incision was made, and the uterus was found to be bicornuate, the right horn being pregnant. The cornua communicated with a single cervix.

The left horn was amputated near the cervix and was found to have a mucosa greatly thickened by decidual formation. The right horn was then opened, the pregnancy removed, and the opening closed with catgut applied in layers. The round and broad ligaments were then stitched to this horn in such a manner as to make it lie in the normal position.

Behind the cervix the peritoneum, pushed upwards by the pressure of the pelvic cyst, was opened. The cyst was evacuated, its content being a thin, clear fluid. It resembled a simple parovarian cyst and was so firmly adherent to the floor and lateral walls of the pelvis that it could not be safely removed. The edges of the large opening made in it were stitched to the peritoneum and the sac allowed to remain to form the pouch of Douglas. The patient made a good recovery.

2. Multiple fibroids with pregnancy in a uterus from which five tumors had been previously removed, together with extensive pelvic peritonitis and inflammation of the appendix, the latter being firmly adherent to the uterus. The patient, aged thirty-two, had been married nine years. Two years previously, five fibroids had been removed in early pregnancy by abdominal section, although she could give no details as to the size and situation of the growths. The operation was followed by abortion after three weeks. On examination an irregular nodular mass occupied the pelvis, extending three inches above the pubes. It was fixed and very tender. The patient had missed three periods. There was constant pain in the lower abdomen, especially on the right side, and marked irritability of the bladder.

Abdominal section was performed. The uterus was enlarged by multiple fibroids and a pregnancy, the latter being about three months advanced. One fibroid mass was developing between the bladder and cervix. Another extended into the left broad ligament. Both ovaries, tubes and uterus were buried in adhesions to the sigmoid flexure, omentum, and small intestines.

The appendix was eight inches in length and firmly adherent to the uterus near the right ovarian ligament. Supravaginal panhysterectomy and appendectomy were carried out. The patient made a good recovery.

3. Case of repeated tubal pregnancy.

In June, 1910, Mrs. E., aged 30, consulted me, complaining of pain in the right side and slight uterine hæmorrhage since her last period, four weeks ago. This period was two days overdue. She had suffered from dull pain in the right side for ten years following typhoid. Within the last four weeks it was quite sharp at times.

On examination, the uterus was slightly enlarged, retroflexed, and containing a few small fibroids. There was a soft swelling on the right side of the uterus, and the whole right lower quadrant was tender. I advised her to go to the hospital at once. However, she waited twenty-four hours before doing so. On admission she felt weak and said that she had felt very sharp pains while traveling from her home. Abdominal section was performed. A ruptured right tubal pregnancy was found; considerable free blood was found in the abdomen. The appendix was thickened and adherent. The appendix and right appendages were removed and the round ligaments shortened. The patient made a good recovery.

In November, 1912, the patient again consulted me. She complained of continued slight dribbling of blood since her last period, four weeks ago. This period had been three days overdue. During the past four weeks there had been pain in the

left lower quadrant which was very sharp at times. She stated that her health had been good since her previous operation. I advised her to go to the Presbyterian Hospital. Abdominal section was performed. Some free blood was found in the abdomen. The left tube was pregnant and in progress of aborting through the dilated fimbriated end. The uterus was enlarged and boggy, and there were many recent adhesions to it and the left adnexa. The affected parts were removed. The patient made a good recovery.

4. Specimen of a tubo-parovarial cyst. This was removed from a woman, aged 22, married a year and a half, and never pregnant. She complained of irregular menstruation since April, 1912, backache, constipation and increase in size of the lower abdomen during the previous eight months. She stated that her health had been good until April, 1912, when the period was four days late.

On examination the uterus was somewhat enlarged. An elastic swelling five inches in diameter was felt in the right lower quadrant. Abdominal section was performed. There was a left hydrosalpinx and enlarged ovary buried in adhesions. On the right side the ovary was normal. The right tube was thick and hard at the uterine end. The outer portion was elongated and distended and communicated at the outer fimbriated end with a thin-walled parovarial cyst which was situated between the folds of the broad ligament, and which contained a thin, clear fluid. The left diseased tube and ovary and the right tubo-parovarial cyst were removed. The woman made a good recovery.

The chief interest of this specimen is its rarity. It is common to find tubo-ovarian cysts. Sometimes a tube may communicate with an ovarian hydrocele. The writer has never before seen a tubo-parovarial cyst.

Dr. Albert Goldspohn: One of the cases reported by Dr. Webster emphasizes the propriety of the removal of the appendix, which should have been done during one of these many operations preceding this. The fact was first emphasized, I believe, by Dr. Howard Kelly that even if the appendix appears perfectly innocent and normal, if it is within the reach of the field of operation it should be removed, because it is apt to become entangled with adhesions and then make trouble. I have had two such cases where the appendix was innocent in my judgment, and both were operated as emergency cases for virulent appendicitis, one at eight months, and the other at eighteen months after an ordinary abdominal section.

Dr. W. A. Newman Dorland: Dr. Webster's remarks on repeated extra-uterine pregnancy reminded me of the first abdominal section I performed. It was a case of repeated extra-uterine pregnancy. Two years after I had helped Dr. Baer to operate on this woman for ectopic gestation, I went in upon the opposite side and removed an extra-uterine pregnancy. An interesting point about the case was, the woman made her own diagnosis, claiming that she had now the same condition that she had two years before on the other side. There was rupture one week later, at Atlantic City. I operated on her, and found the same condition that had been present two years before, but on the opposite side.

Dr. Channing W. Barrett: A woman was brought to me about seven years ago from Bristol, Wisconsin, by Dr. Stevens, with a diagnosis of extra-uterine pregnancy. The right tube was removed, and adhesions about the uterus broken up at the time, and the left tube and ovary found healthy. She had been married twelve years. It was her first extra-uterine pregnancy on the right side. Four years later she was brought back with the same symptoms. She made her own diagnosis, and it was found she had an extra-uterine pregnancy on the left side. This is the only case in which I have operated on both sides.

In regard to appendicitis complicating pregnancy, in the last year and a half I have had five cases, the last one at the Cook County Hospital, in which I removed an acute appendix from a woman between seven and eight months pregnant. The appendix was adherent to the posterior surface of the uterus. It was easily freed.

There is one point I would like to call attention to and that is, in dealing with these cases it is almost necessary to make the incision much higher anatomically than we do ordinarily for appendicitis, as the appendix is crowded upward and backward at that time. In fact, at the time the uterus grows out of the pelvis and begins to grow upward above the pelvic brim, trouble is likely to ensue. This patient had had some symptoms of abortion before the operation was done. She had some contractions, but no hæmorrhage or dilatation. A few days after operation she aborted or miscarried. The child was alive, and at last accounts it was living. The patient made a good recovery.

In the previous case, the patient was between the sixth and seventh month of pregnancy; she had an acute and gangrenous appendix, and the appendix was found flattened out nearly like a leaf in the iliac fossa, the uterus pressing upon it

so that it was flattened out considerably. That woman had had severe symptoms of abortion in the form of contractions, and by the time she was ready to get up from bed after operation, which was about ten days, she aborted. She made a good recovery.

DR. RACHELLE S. YARROS: I, too, had a case of a woman who made her own diagnosis of extra-uterine pregnancy. She came to me stating that two years before she had been operated on for a left tubal pregnancy, and now was only three or four weeks pregnant, but was having the same signs and symptoms. The uterus was somewhat enlarged, there was a little bloody discharge, and a small mass in the line of the right tube. She was complaining of occasional colicky pains on that side. I advised her to let me watch her for a while because I was unable to make a positive diagnosis. Three weeks later I saw her again, the uterus had increased in size, and the mass was decidedly larger. There was a dark, sticky discharge, and the patient complained of pain on that side. I advised operation. The family were unwilling to have her operated on, and decided to wait a little while. During the next two weeks she had, off and on, small hæmorrhages, and was taken to see one of our best obstetricians. He diagnosed uterine pregnancy, and threatened miscarriage. One night she had quite a severe hæmorrhage and was packed for it by his assistant. The patient resented the fact that the doctor did not come himself to attend her, and the next morning was brought to the West Side Hospital, and I was again asked to continue the care of the case. I told the patient that I would overlook the discourtesy because I was anxious to establish that my diagnosis was a correct one. The question of a possible uterine pregnancy, besides the extra-uterine, had to be considered now, because the patient had lost a good deal more blood from the uterus than I had ever seen in an extra-uterine pregnancy. We decided to currette and removed a good deal of material, indeed, as much as one would expect from a six or eight weeks' pregnancy. But on examination it was found to be entirely of a decidual character, and no chorionic villi found under the most careful examination. The mass on the right side was very distinct and again larger than it was at a previous examination. An operation for the removal of the tube was urged, but the husband refused his consent, and the patient passed out of my hands. A month later I obtained the following statement from her friend, which was subsequently corroborated by the patient: That a few days after she left the hospital, she consulted the surgeon who had operated on her for the first extra-uterine pregnancy, and he diagnosed salpingitis following curettage, which, it is needless to say, was not the case. I am glad to say that he did not know that I was her physician when he thus spoke, but he did know that she was taken care of by a woman doctor. The patient disagreed with the surgeon's diagnosis, and insisted that if she were to go to the hospital for treatment, he must call in the hospital gynecologist for consultation—who is, by the way, one of our best. The consultant concurred in the diagnosis of salpingitis, and she was put to bed in the hospital and treated accordingly. After remaining there for two weeks, she was pronounced much improved, and was advised to go home the next day. In the middle of the night the doctors were summoned and found the patient in collapse. They operated and removed a right ruptured tubal pregnancy.

BOOK REVIEWS

THE PRACTICE OF OBSTETRICS. Designed for the use of students and practitioners of medicine. By J. Clifton Edgar, M. D. Fourth edition, revised. Philadelphia: P. Blakiston's Son & Co., 1913.

In a work so admirably prepared as this there can be but little to criticise and much to commend. In some respects there is room for difference of opinion, which in nowise impairs the value of the book. As a whole the teaching of obstetrics as exemplified by Dr. Edgar is that endorsed by the leading obstetricians of the world. Some parts of the book merit special mention and commendation, notably such articles as the excellent ones on position in obstetrics and the use of the vaginal and uterine tamponade, the latter a subject frequently slurred or altogether omitted in text-books. The subject of pelvimetry is ably discussed and copiously illustrated.

In common with most conservative surgeons, Dr. Edgar takes a stand against the use of spinal anæsthesia as applied to obstetric operations. In the light of the present experience with this method of anæsthesia, its use in obstetrics would hardly be justified and might even be regarded as reprehensible. Both ether and chloroform should be considered safer and more convenient in the average case of childbirth.

While not condemning vaginal Cæsarean section, he shows the superior merits of the abdominal operation in most cases and especially in instances in which the advocates of the vaginal operation have loudly proclaimed its superiority. The subject of acetonuria in pregnancy is dealt with in a sane and rational manner. The author rightly decries the termination of pregnancy in this condition, even when acetone is present in marked quantities, unless other urgent symptoms indicate grave danger should generation be allowed to continue. The grouping and illustrations of the various teratologic conditions are excellent.

Especial attention has been given to the various pathologic features of obstetrics, all of which have been brought thoroughly up to date.

New material in this edition includes such interesting subjects as the vaccine and serum treatment of sepsis, blood-pressure observations, hæmorrhage of the new-born infants, pelvimetry of the lower strait, funnel pelves and their treatment, pubiotomy, extraperitoneal Cæsarean section, and the Momburg belt constriction for hæmorrhage.

The book is a valuable one and well worthy of a place in the library of the accoucheur and gynecologist.

A SYSTEM OF TREATMENT. Edited by Arthur Latham, M.A., M.D., F.R.C.P., and T. Crisp English, M.B., B.S., F.R.C.S. Volume IV, Obstetrics and Gynecology. New York: The Macmillan Company, 1912.

The fourth volume of this system of treatment prepared by many English writers is devoted to the subjects of obstetrics and gynecology and to a general index referring to the entire system. The aim of the volume is to provide the general practitioner with a series of practical articles, in as concise form as possible, describing the modern methods of dealing with all diseases, and written by those who have had special experience in the subjects with which they deal. So far as the subjects of obstetrics and gynecology are concerned, this aim is excellently carried out in the present volume. The material is arranged with particular reference to therapy, consisting of various series of short articles, rather than chapters, each signed by the writer preparing it. The text is clear, the sub-headings are given in broad-faced type and throughout there has been an effort toward systematic arrangement. Thus the treatment of the contracted pelvis is handled in a dozen pages. The various degrees of contracture are taken up in separate paragraphs and the rarer forms of contractures discussed separately. Prophylaxis is notfor gotten and Prochownick's dietary is briefly set forth. A short list of references closes this theme. This method, of course, tends to dogmatic expression, the avoidance of which is in some places quite evident and in others leads to uncertainty through too guarded assertion.

Obstetrics is given slightly more space than is gynecology. The general management of pregnancy is first presented, followed by a series of articles on its complications and abnormalities. Besides the commoner conditions, such topics are treated of as pendulous belly, uterine and vaginal prolapse, varicose veins, albuminuria, etc. Placenta prævia, tubal pregnancy and eclampsia are also included here. The management of normal labor and of labor in special presentations is presented by that master of the Dublin School, E. Hastings Tweedy. The complications of labor, the management and the complications of the puerperium are taken up in turn, followed by topics concerning the new-born child. The technique of obstetric operations is contributed to chiefly by Comyns Berkeley, with the able assistance of Powell, Kerr and Roberts.

The gynecological section of the volume is introduced by Victor Bonney in a discussion on general

points in the technique of operative procedures and their after treatment. The Edinburgh school is represented by Ballantyne in the management of puberty and the menopause. Then comes in order the various gynecologic diseases classified according to the vulva, vagina, uterus, tubes and ovaries. Disorders of menstruation and of the sexual function are treated of briefly as are the diseases of the bladder and urethra. This portion of the work is largely technical, though some space is given to medical gynecology. Brevity is the feature here as is repeatedly demonstrated. Chronic endometritis continues to be a pathological entity and curettage an operation per se. With respect to this procedure the author's views are certainly not in accord with many British and most American gynecologists.

In imprint the book is excellent and the illustrations, while not numerous, are well chosen and to the point. CAREY CULBERTSON.

SURGICAL OPERATIONS. A handbook for students and practitioners. By Prof. Frederick Pels-Leusden. English translation by Faxton E. Gardner, M. D. New York: Rebman & Company.

This book has many excellent qualities, and there will be few surgeons who are not able to derive distinct benefit from a perusal of its pages. Of course it is not filled with the operations in the priority of which so many Americans are interested, and those who confine themselves to English and American literature will find that other minds have been working along the same lines and that our German cousins have quite a few opinions as to priority. We in the West miss Mayo's imbrication method for umbilical hernia most markedly, and there are numerous other names associated with operations that are missing in this book.

When one reviews a book he should look for the parts of the book that are the best, and they should be shown as well as possible, if the book possesses any merit at all.

One feels that much valuable space and time have been lost in discussing, illustrating and describing so many ligations that one seldom uses. The operations upon the extremities are clearly illustrated and well described.

In surgery of the head, large osteoplastic flaps are made everywhere, even in the occipital bone, where it is not a very easy task. The face operations are the ones usually portrayed in operative surgeries.

In the surgery of the neck and chest, the indications for operative interference are well made and the operations very clearly described.

In the abdominal work many things familiar to us are missing, but the ideas are good and the surgical technique clearly described. The book may be criticised for the absence of appropriate legends beneath the illustrations, instead of the size of the instruments, etc.

As a whole, however, it is very instructive and will be of value to get a view that everyone is not portraying.

The author devotes a chapter to anæsthetics which is concise and valuable. The chapter upon the division and reunion of tissues would be markedly improved if the nails and plates of same were considered.

SURGICAL OPERATIONS WITH LOCAL ANÆSTHESIA. By Arthur E. Hertzler, M. D. New York: Surgery Publishing Co.

Any surgeon who has had a wide experience with anæsthesia appreciates the great dangers incident to complete narcosis, and will therefore feel grateful to Dr. Hertzler for his excellent little manual detailing the technique of local anæsthesia in the various parts of the body. It is well illustrated and will be found to be of great value, both to those who do little operating and to the general surgeon in special emergencies.

GYNECOLOGY. Vol. IV of The Practical Medicine Series. By Emilius C. Dudley, A. M., M. D., and C. von Bachelle, M. S., M. D. Chicago: The Year Book Publishers, 1912.

This volume of abstracts of the most important literature of the year relative to gynecology is presented again under the same authorship as previous collaborations. In general arrangement there is no change, the classification responding excellently to the demands of a book of this nature. The various articles summarised are chosen with breadth of view and are condensed with true editorial insight. These abstracts are for the most part concise and systematic, with conclusions in one, two, three order wherever possible. Thus the volume comprises a fund of information for the general reader of medicine, for whom, indeed, it is primarily published. On the other hand, to one who makes an effort to keep in touch at all times with the most advanced word in gynecology, it is of interest to peruse this compilation that he may the better measure the relatively little advance that is made in the course of one short year. Certainly it is surprising how many articles are prepared by authors whose very writings fail to reveal knowledge of pre-existing literature, ideas, or theories. That a volume of this nature must be widely inclusive, however, oges without argument.

Many of the articles chosen for review are abstracted in detail and elaborated with reproductions of the original illustrations, all of which enhances the value of the material thus prepared. Frequently there is appended to an abstract some trenchant and concise opinion from the pen of the editor, remarks which are always to the point and which bring for the volume additional value to the reader. The book is, of course, uniform in its publication with the other volumes in this series. CAREY CULBERTSON.

ANATOMY AND SURGICAL ANATOMY OF THE CŒLIAC AXIS AND ITS BRANCHES, THE HEPATIC ARTERY IN PARTICULAR. By Dr. P. do Rio-Branco. Paris: G. Steinhiel.

This volume is the result of exhaustive personal research and study of anatomical literature.

It comprises five parts, viz.: 1. The cœliac axis. 2. The coronary artery of the stomach. 3. The splenic artery. 4. The superior mesenteric artery and its branches, normal and abnormal, which anastomose with the hepatic artery. 5. The hepatic artery.

The author reviews the historical development of the regional anatomy, as well as the embryonal development of the parts, facilitating the comprehension of the developed vessels and their anomalies. The text minutely describes the relations, size, ramifications and anastomoses not only of the arteries and their branches but of their multiform anomalies as well.

The work stands as a monument to painstaking dissection and comprehensive observation of a vast amount of material. H. A. POTTS.

REFERENCE HAND-BOOK OF THE MEDICAL SCIENCES. Vol. I. Third edition, edited by Thomas Lathrop Stedman. New York: Wm. Wood & Co., 1913.

An exhaustive treatise, alphabetically arranged, on the medical sciences.

This is a most complete volume and carries the reader as far as bacteriologic technique. It is profusely illustrated, with many excellent illustrations. The articles are written by men high in the profession, and hence are authoritative.

In glancing through the volume the reviewer is struck by the completeness of the articles on surgical anatomy of the abdomen, abdominal injuries, and abdominal tumors. Also, by the comprehensive way in which the various diseases, especially skin diseases, are treated.

One is surprised that a book of this magnitude should take up to such an extent the question of bacteriology, which begins with a general discussion, then describes each of the pathogenic bacteria and their characteristics. Accompanying this portion of the book are three fine plates showing the various bacteria. Bacteriologic technique is also minutely described.

The book is one that should prove of great value to anyone connected with the practice of medicine, not only from a scientific standpoint but also for general information pertaining to medicine, since biographies are given of those who have attained distinction in the various lines of medical science. Should the remaining volumes be as complete as the first, the Reference Handbook should form a very useful addition to the library of any physician.

CLIFFORD G. GRULEE.

A COURSE IN OPERATIVE SURGERY. A handbook for physicians and students. Second Edition. By Prof. Dr. Victor Schmieden. Liepzig: Johann A. Barth, 1912.

The present revised edition contains much which is new and up to date, having six new chapters added, viz., bone-suture, aspiration of joints, tamponade (Bellocq), extraction of teeth, and extirpation of inguinal and cervical glands. The text is profusely illustrated by excellent cuts.

The book is admirably adapted for teaching operative surgery upon the cadaver and is of service as a reference to both graduate and student. A translation in English will soon appear.

H. A. POTTS.

LIFE AND LETTERS OF DR. WILLIAM BEAUMONT. Including hitherto unpublished data concerning the case of Alexis St. Martin. By Jesse S. Meyer, A. B., M. D., with an introduction by Sir William Osler, Bt., M. D., F. R. S. St. Louis: C. V. Mosby Company, 1912.

This entertaining and beautifully written biography commemorating the one hundredth anniversary of Dr. Beaumont's entry into the practice of medicine is a fitting tribute to the man who under adverse circumstances was first to study the physiology of digestion and lay the foundation for physiological chemistry in America.

Other biographical sketches have appeared, which have dealt mostly with Beaumont's contributions to medicine, but the author discovered two chests containing personal belongings and correspondence which are now in possession of Mrs. Sarah Beaumont Keim, a daughter now living in St. Louis.

From these records and letters, together with other data, especially those on file in the Surgeon-General's Office, the author has compiled an authentic volume which justly portrays the life of the first great American physiologist, a methodical conscientious, good man, who by his courage of conviction, honesty of purpose and unbiased observations justly earned the veneration of his fellowmen.

The book contains many reproductions of his correspondence with noted men of his time, many purely personal, others professional. His detailed records of the gastric fistulæ and his correspondence with his patient, St. Martin, are entertaining and enlightening in the extreme.

The appendix contains an account of St. Martin's last days, which were spent in poverty and want. He died at St. Thomas de Joliette, June 24, 1880, surviving his benefactor and friend 28 years.

References and abstracts of cases of gastric fistulæ prior to that of St. Martin are also reported.

H. A. POTTS.

LANDMARKS AND SURFACE MARKINGS OF THE HUMAN BODY. By L. Bathe Rawling, M. B., B. C. New York: Paul B. Hoeber, 1912.

This volume, appearing in fifth edition, deals with the head and neck, upper extremity, thorax, abdomen, and lower extremity. The figures accurately outline the structures beneath the surface. The text explanatory of the figures gives the various relations of important structures, with directions for calculating their positions relative to the surface markings and bony landmarks, e. g., middle meningeal artery. An appendix gives the length of various passages, tubes, etc., also the weights of some organs. A table giving the generally accepted time of ossification of the epiphyses and of the bones of the upper and lower extremities is also added.

The book will prove useful to teachers and as a reference for the surgeon as well. H. A. POTTS.

THE WASSERMANN REACTION: ITS TECHNIQUE AND PRACTICAL APPLICATION IN THE DIAGNOSIS OF SYPHILIS. By John W. Marchilden, B. S., M. D. St. Louis: C. V. Mosby Co., 1912.

The author's purpose in this little volume is to acquaint the student and practitioner possessinga certain amount of laboratory training and skill with the precise technique of the reaction, giving him complete information as to collection of materials required.

The reaction is clearly and concisely analyzed, complete directions being given for the preparation of hæmolysin, complement, red blood corpuscles, serum from the patient, antigen, etc.

Results of the reaction in diseases other than syphilis are also discussed. The book is a ready reference for one who has not closely followed the detailed clinical and laboratory development of the reaction. H. A. POTTS.

ELECTRICITY IN DISEASES OF THE EYE, EAR, NOSE, AND THROAT. By W. Franklin Coleman, M. D., M. R. C. S. Chicago: The Courier-Herald Press, 1912.

In this instance the author has departed from the style usually adopted by writers of text-books on electro-therapeutics with the happy result of producing something interesting as well as instructive. An enthusiastic student of electro-therapeutics, Dr. Coleman has brought within the compass of a single volume a wealth of information gathered not only from his own personal experiences and from those of his friends and associates, but from an exhaustive search of the literature as well.

The book opens with an introductory section devoted to the physical properties of electricity and the application of electric currents to the treatment of disease. Following this prefatory portion, the particular conditions of the eye, ear, nose and throat, in which the various electric modalities have proven of service, are presented.

In his intention to make the work of practical value to the busy physician the author has been eminently successful. Lucid in style, there is a complete absence of verbose descriptions or untried theories; instead there is an orderly arrangement of the various pathological conditions, with a crisp, clear-cut account of what has actually been accomplished. One who has never employed electro-therapeutic measures in the special fields here embraced will find much that is helpful in affording relief to a class of patients that, under the more usual methods, are almost hopeless. Those already familiar with the subject will find many new uses for this most helpful agent.

On page 304 is an observation on the diagnosis of cysticercus oculi attributed to Vincentiis, who made use of both the faradic and direct currents. At the moment of opening the circuit the cestode was observed to contract. This statement deserves more than passing notice, as it conclusively establishes the fact that electric currents penetrate the eyeball instead of following a path of lower resistance around it, and wherever a current reaches it is not only capable but actually does perform work. That the reaction was not a mere coincidence but an actual result is substantiated by the well-known fact that the protoplasm of all of the lower orders of animal life is extremely susceptible to electrical influences.

The advent of the book is timely, for our literature contains little on this particular subject, and that so scattered that it has not been readily available. Undoubtedly, much that has been written on electro-therapy has been published in the first enthusiasm of success, and requires a stronger assistance to digestion than normal saline; but case reports such as are here presented, in which all essential data are fully recorded, demand serious consideration. To those of us who have carried to a successful termination even a single case that without such aid must have ended in failure, the book comes as a confirmation of our own experiences, and as an incentive to renewed study of an agent whose power for good is still so little known.

BOOKS RECEIVED

INSURANCE MEDICINE. By Henry H. Schroeder, M. D. New York: Wm. Wood & Co., 1913

DISEASES OF THE STOMACH. By George Roe Lockwood, M. D. Philadelphia and New York: Lea & Febiger, 1913.

VACCINE AND SERUM THERAPY. By Edwin Henry Schorer, B. S., M. D. St. Louis: C. V. Mosby Co., 1913.

HYGIENE AND SANITATION FOR NURSES. By George M. Price, M. D. Philadelphia and New York: Lea & Febiger.

THE NARCOTIC DRUG DISEASES AND ALLIED AILMENTS. By George E. Pettey, M. D. Philadelphia: F. A. Davis Co., 1913.

GENERAL AND SPECIAL PATHOLOGY. By Henry T. Brooks, M. D. Philadelphia: F. A. Davis Co., 1913.

GYNECOLOGICAL OPERATIONS INCLUDING NON-OPERATIVE TREATMENT AND MINOR GYNECOLOGY. By Henri Hartmann, M. D. Philadelphia: P. Blakiston's Sons & Co., 1913.

PREVENTIVE MEDICINE AND HYGIENE. By Milton J. Rosenau, M. D. New York: D. Appleton & Co., 1913.